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The David Hughes Centenary

THE fifty-ninth annual general meeting of the Institution of Electrical Engineers held last week will be a memorable one, for it was the occasion of a discourse commemorative of the birth of David Edward Hughes, whose two outstanding discoveries (a more apt word than "invention" in the case of most of his experimental research) were the synchronous printing telegraph and the microphone.

In his delightfully entertaining manner Mr. Sydney Evershed, whose lectures are too few and far between, told us something of the life and work of Hughes, which was characterised by striking originality of thought, as inventions made outside an industry often are, and completely practical adaptation of means to an end. By what mental process of reasoning he was led from one experimental step to another even his surviving note books do not reveal, for he was by no means a theorist and certainly knew little mathematics. He spent the best part of his short life in creative work, from which we benefit to-day, happy in the absorbing interest of his investigations, and in the ample means (he left nearly half-a-million sterling) the earlier ones brought him contrasting oddly with his frugal mode of living.

His telegraph brought him fame as well as fortune. Napoleon III created him a Chevalier of the Legion of Honour, the Czar of Russia invested him with the Order of St. Anne, from the Emperor of Austria he received the Order of the Iron Crown, and from the Sultan of Turkey the Medjidieh Order, from Bavaria the Noble Order of St. Michael, and he was made a Commander of the Royal and Distinguished Order of Carlos III of Spain. Laden with these tributes, he returned to his birthplace to live a humble life, but his genius could not be hidden, and his discovery of the microphone at last compelled his own unappreciative country to acknowledge him.

It is instructive to reflect that, while Hughes was not the first to employ a radiating primary circuit, his secondary circuit was entirely novel. All the early experimenters, without knowing it, must have been generating electromagnetic waves, and in occasional instances detecting them at a distance. The discharge of Leyden jars and the periodic breaking of the circuit of primary coils must have been done under conditions which, as we now know, resulted in high-frequency oscillation and the consequent radiation of energy from the primary circuit.

They were all working on the edge of a vast field of discovery, but none of them found the gate of admittance. Even after Clerk Maxwell (the centenary of

whose birth will occur next month, to be followed three months later by that of Michael Faraday's fundamental discovery) had forged the key to the gate by his electro-magnetic theory of light, many years elapsed before Hertz used that key to unlock the gate and lead his followers into pastures new wherein commenced that work of exploration which culminated in radio communication as we know it to-day.

Unfortunately part of Hughes's work, perhaps the most epoch-making, remained unpublished, and was consequently lost to the world for nearly 20 years (see "The Experiments of Prof. Hughes on Ether Telegraphy," ELEC. REV., June 2nd, 1899). He lived to see much of it justified, however, though unrecognised as one of the true pioneers of wireless telegraphy.

To echo Mr. Evershed's sentiment: when next spoken to by a distant friend by telephone remember Alexander Graham Bell, and when replying into the microphone have a thought for David Edward Hughes, and their beneficent services to mankind.

The Salary Schedule

A CORRESPONDENT asks us where he can obtain details of the National Joint Board Schedule of Salaries which is so often referred to in our advertisements of vacant situations. If this were an isolated instance it would not be necessary to allude to it here; but in the last year or two we have had many requests of this kind. In the first place we may say that we last published the Schedule in our issue of July 25th, 1930, and, secondly, we would draw attention to the existence of the Electrical Power Engineers' Association which negotiated the Schedule with the electricity supply undertakers, and from whom all particulars regarding salaries and conditions of service may be obtained. It seems strange that men applying for positions in electricity supply undertakings are not aware that there is such an Association. Probably the stress of modern times is forcing men out of other industries and causing them to look towards one which maintains its progress in spite of adverse conditions. We anticipate that the present Schedule, which remains in force until the end of June, will be superseded by lower rates, as the cost of living has fallen during the past year.

Immediate Action

THE prominent part played by our electrical manufacturers at the Buenos Aires Exhibition proved that they as individuals, and the B.E.A.M.A. as their organisation, were wideawake to the need for a strong trade-getting policy in South America. They have the satisfaction of knowing that before the Prince of Wales delivered his stirring speeches they had taken very definite action in the directions indicated therein. We shall not be undervaluing the splendid aims and efforts of His Royal Highness if we recall the many occasions upon which expert trade advisers have given similar counsel in reports to our producers. But those who have been apathetic or lethargic in their attitude toward the warnings of officials at other times may listen when royalty speaks after personal investigation at this particular period of national emergency and stress. Any danger that seemed possible that after the Buenos Aires effort enthusiasm would die away is, we trust, disposed of by the setting up of a special Argentine Committee of members of the Federation of British Industries, interested in the trade with that country. The first meeting of such committee will be presided over by Mr. Victor Watlington, chairman of the B.E.A.M.A. Council, who was head of the F.B.I. delegation to Buenos Aires. The initiative already taken, through the Exhibition, will be maintained, and plans have been made already for strengthening British industrial representation in Argentina and for inaugurating a regular system of publicity for British goods in that market. We hope that the committee will not let the grass grow under its feet; and we entreat electrical manufacturers not connected with existing organisations to take up the matter for themselves. As an industry we must have a more aggressive trade policy for the whole of South America if we are to counteract the influence of foreign competitors who have strengthened their position by securing a certain measure of financial control.

Railway Electrification

THE statement in Parliament forecasting the 260 million pounds scheme for main-line railway electrification, was made as part of the Government proposals for dealing with unemployment. Not unnaturally questions have since been asked by members who want to "get a move on" with work-finding measures. Remembering the pace at which railway authorities have proceeded with electric traction schemes in the past, we are doubtful whether the reply by the Minister of Transport can be regarded as encouraging. He told the House last week that the committee's recommendations had been referred to the principal railway companies asking for their observations as soon as possible. We hope that they will show more than their accustomed expedition. The electrical industry has heard of schemes and rumours of schemes so often that it is restless for something more tangible, even if it be but a few miles here and there, instead of waiting years for the approval of the whole scheme.

More Telephone Business

IF main-line railway electrification presents a rather distant prospect for one branch of the electrical industry, another branch can be sure of more immediate business. In the House of Commons last week, the Assistant Postmaster-General made a lengthy defence of the telephone service, maintaining that the department had done exceedingly well and that progress had been remarkable. However true this may be, there is tremendous scope for expansion and the telephone manufacturers will heartily welcome the announcement that over £32,000,000 is to be spent on development in the next three years—or sooner if the demand is accelerated, as it ought to be.

The Land Tax

WITHOUT discussing the merits or shortcomings of the Government's land value taxation proposals, we may at least express satisfaction that certain public undertakings, such as electricity supply, are to be exempt from the levy. It is still a matter of considerable concern to such undertakings that they were excluded from the benefits of the "De-Rating Act" of 1928, although several efforts were made to extend the relief to them while the measure was passing through its various stages. It is probably too late to reopen the matter now, but the effect has been severely felt by all electricity undertakings that are helping to bear the burden of which manufacturing industries (including brewing and cigarette-making) have been relieved.

Bad and Good

IT is discouraging to find that there are a number of undertakings in this country which do not hire out domestic appliances because they fear the financial risk; they can only harm the cause of domestic electricity supply by openly putting before prospective consumers as a reason, the alleged instability of domestic apparatus. Such concerns might profit a good deal by the lesson offered in an outstanding example of local enterprise by the Tientsin (China) British municipal electricity supply undertaking. This organisation, because it finds it impossible to hire out imported cooking apparatus, owing to unfavourable money exchange, is making its own cookers and heating units, and great credit is due to the Department as the "home made" cookers have given every satisfaction, and because of some hundreds of the heating units made in the local showroom there has not been a single failure in two years. The conditions in Tientsin are peculiar, and it is not, of course, suggested that undertakings at home should set up as cooker manufacturers, but in the example is the valuable lesson referred to.

The Expansion Circuit Breaker

A new heavy-duty switch of German design which dispenses with oil in favour of arc quenching by saturated water vapour

By Dr. FRITZ KESSELRING, Berlin

SIDE by side with its great advantages, mainly in respect of simplicity of construction and ease of maintenance, the oil-immersed circuit breaker has the one serious disadvantage that the arc-quenching medium (oil) is inflammable, the products of gasification (*viz.*, methane, ethylene, and hydrogen) forming with the oxygen of the atmosphere an explosive mixture whose ignition may cause serious destruction, aggravated by fumes from the burning oil. It is of the utmost importance that it should be generally realised that oil-switch explosions are in no way concomitant with the rupturing of large power, for a few amperes may be sufficient to bring about explosive conditions. Should, for example, the operating mechanism of an oil switch fail in such a manner that the contacts merely touch one another, then the small arc there forming will, in the course of time, cause the surrounding oil so to decompose that the tank will be filled with an explosive mixture. Experience has proved that oil-switch failures are to be attributed to faults in the operating gear rather than to the rupturing of large power.

Appreciation of this inherent weakness has directed efforts to the replacement of oil by some other quenching medium. For instance, the Westinghouse "Deion" circuit breaker in America, the air-blast breaker of Whitney and Wedmore in England, and of Ruppel in conjunction with the Allgemeine Elektrizitäts-Gesellschaft in Germany. During 1927 and 1928 Siemens-Schuckert (S.S.W.) were also occupied with the development of an air-blast breaker, and at the same time continued its research work on an expansion breaker, an entirely new type that possesses all those advantages which

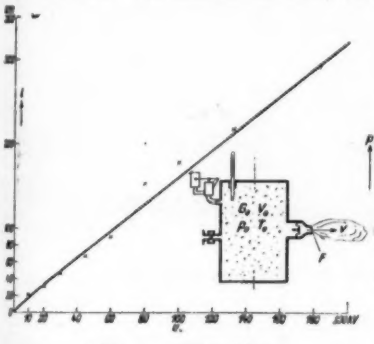


Fig. 1.—Breaking Distance

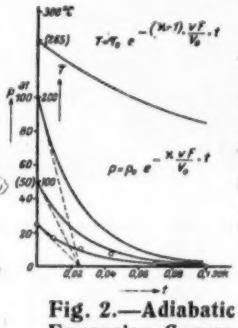


Fig. 2.—Adiabatic Expansion Curves

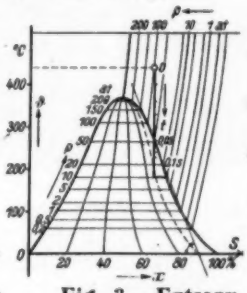


Fig. 3.—Entropy Diagram

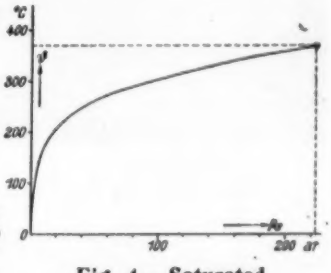


Fig. 4.—Saturated Water-vapour Pressure-temperature Characteristic

secured for the oil switch the unassailable position it has held for the past 30 years, and is in many respects superior even to the air-blast breaker. In contradistinction to the oil type the expansion type operates in a non-explosive liquid, consisting essentially of water with certain added ingredients. Several hundreds of these breakers are at present in operation and have, during the past two years, given every satisfaction.

Underlying principles.—If an inductive circuit carrying, say, 100 amperes at 60,000 volts be broken in air by the separation of metal electrodes, the arc will, in general, be extinguished only after the electrode separation reaches 18 metres. If the same electrodes be immersed in a liquid (*e.g.*, water or oil) the arc will be extinguished when the separation is about 1.8 metres. It therefore follows that the only effect of the introduction of a liquid as the surrounding medium is to render the conditions for maintenance of the arc less favourable. With the object of finding means of still further reducing the length of the arc, let us examine the physical phenomena associated with the pressure of a liquid medium.

Every a.c. arc is extinguished each time the current passes through its zero value, quite independently of whether the arc forms in air or in a liquid. Only two physical phenomena can possibly occur: should the ionisation resulting from bombardment and the emission of electrons from the incandescent contacts preponderate over the deionisation due to cohesion, re-association, &c., then the arc will re-establish itself; conversely, the arc will remain extinguished.

In air, the deionisation process takes place comparatively slowly, so that the quenching of the arc commences only when the arc length becomes great. If the arc is formed in an atmosphere of hydrogen, deionisation is singularly accelerated as a result chiefly of the high thermal conductivity of hydrogen; the following formula[1] gives the maximum length of the arc which can nevertheless form in an atmosphere of hydrogen:—

$$l = \frac{U}{0.29} \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

wherein U denotes the recovery voltage and l the length of the arc in centimetres. On comparing arc lengths given by equation (1) with the lengths of break in oil of circuit breakers it will be seen that the total length of break for a definite recovery voltage agrees fairly closely with the values given by the equation. This is illustrated by fig. 1, in which the plotted points correspond to the breaking lengths of the older types of oil switches manufactured by the S.S.W., whilst the line is that given by equation (1). It follows that the quenching of arcs carrying small currents is to be ascribed to the presence of hydrogen, as the gas mixture formed at rupture contains 70 per cent. hydrogen, produced by the decomposition of complex hydrocarbons.

It has, however, been determined experimentally that arc lengths in liquid switches when breaking more than 1,000 amperes are considerably smaller than those given by equation (1), so that the quenching of the arc must be attributed to some further deionisation effect. It can be shown that the spherical space surrounding the arc contains not only gases, but also considerable quantities of vapour[2]. Research into the temperature drop in the immediate vicinity of the arc has indicated that within 2 millimetres of the 3,000 deg. C. Kelvin zone, temperatures of a few hundred degrees are possible. Experimental verification here supports the figures determined by theory. Hence it is no longer true to state that the arc forms in a gaseous atmosphere, rather is it closely surrounded by a shell of vapour.

The author has observed that a.c. arcs formed in a liquid are always quenched at very short length when, due to any external cause, a sudden release of pressure takes place in the vapour atmosphere surrounding the arc. Gerdien pointed out that deionisation according to the theory of Thomson and Wilson is bound to occur as a result of a collapse of pressure, and electrons and ions become visible when introduced into an atmosphere of saturated vapour which is allowed to expand adiabatically; the electrically-charged particles then form concentration centres for the vapour.

Véronnet[3] and others have shown that between an electron and a *neutral* atom there is mutual attraction which is inversely proportional to the fourth power of the distance between them. Hence the attraction is only effective when the distance between atom and electron is very small; in the case of a gas obeying the general law—

$$PV = RT \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

attraction has no noticeable influence. If, however, the gas be compressed and cooled so that it forms vapour, equation (2) must be replaced by Van der Waal's equation—

$$\left(P + \frac{a}{V^2}\right) \times (V - b) = RT \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

The constant a arises from taking into account the attraction between individual molecules, the magnitude of which can be

[1] The derivation of this formula is explained in another work of the author which is shortly to be published.

[2] cf. von Engel, "Wissenschaftliche Voroeffentlichungen aus dem Siemens-Konzern," Vol IX, 1930, p. 1, *et seq.*

[3] *Comptes Rendus* de l'Academie des Sciences, Paris, Vol. 189, 1929, p. 1249, *et seq.*

determined from his equation. The values derived in this manner agree closely with those determined by experimental research into the effective range of intermolecular forces. We deduce therefrom that in a vapour the molecules lie so close to one another that they attract each other. Since, as a result of the lower temperature, their speed of motion is also much less than in the case of a gas, intermolecular forces must play a considerable part in the physical phenomena taking place in a vapour. If now an electrically-charged particle finds its way into such a vapour atmosphere, it will always be at a very small distance from some molecule and will thus be attracted to it; in this way an ion is formed, which, on its part, attracts further neutral molecules. At the conclusion of this process there arises from it the well known nucleus observed by Wilson in his experiments with supersaturated vapour.

In the case of a gas, in which the distance between the molecules and their speed of motion are very great, only very seldom does an electron introduced into the gas approach so near to a slowly-moving molecule that attraction, and therewith the possibility of ion formation, is possible. From this consideration follows the fundamental difference between deionisation by gases and by vapours.

Having recognised that saturated vapour produces an extremely strong ion-forming effect, let us consider how a vapour atmosphere can be formed in the immediate vicinity of the arc. If a quantity of vapour G_0 is introduced into a totally-enclosed vessel of volume V_0 (see fig. 2) then at a temperature T_0 it will exert a definite pressure p_0. If now this vapour is allowed to escape through a valve of throat area F, a pressure-time record can readily be obtained; the results of a few measurements are shown graphically in fig. 2. Mathematically the pressure at any instant is—

$$p = p_0 e^{-\frac{kvF}{V_0} t} \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

The temperature at any instant is—

$$T = T_0 e^{-(k-1)\frac{vF}{V_0} t} \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

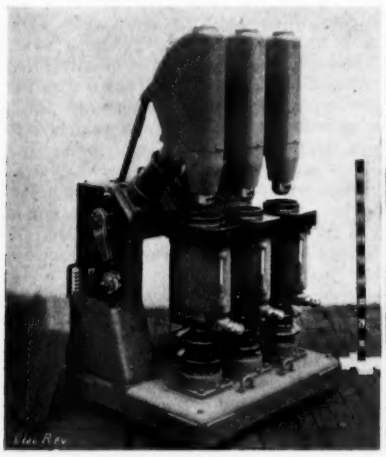
Accordingly the fall of pressure resulting from the release of the vapour is accompanied by a fall of temperature, as is clearly shown by the entropy diagram (fig. 3). The initial condition of the vapour is represented by the state point O, corresponding to a pressure of 100 atmospheres and a temperature of about 440 deg. C. In the case of an adiabatic change of state one may assume the entropy to be constant, at any rate if one leaves out of account any temperature equalisation throughout the vapour itself. The expansion then follows a straight line through the point O, parallel to the ordinate axis. The time scale indicated on this adiabatic curve is obtained by means of the method of calculation already mentioned. In this particular example the pressure takes 0.05 second to fall from 100 to 50 atmospheres. By that time the initially superheated vapour has been cooled to the saturated state and the expansion then continues somewhat more slowly. Of significance now is the quantity of vapour condensed as a result of the augmented cooling. The percentage amount of liquid separated out, *i.e.*, the "wetness" fraction, is represented on the entropy diagram by the horizontal distance between the saturation curve and the adiabatic curve passing through O; for example, after reaching a pressure of 10 atmospheres round about 10 per cent. of the vapour has become condensed. As is shown by the tangent to the saturation curve, one may assume the amount of vapour condensed to be approximately proportional to the fall in temperature, for which reason it will be more correct to regard the temperature drop as being the decisive factor, albeit that direct observation first suggested pressure drop to be apparently the sole determining influence.

A simple arrangement, especially applicable to circuit breakers, for obtaining a large temperature drop is illustrated in fig. 10. It consists of a metal chamber 1 to the bottom of which is secured the fixed contact 2, which is surrounded by a metal cylinder 3 carrying a plate 4 made of insulating material, above which is an insulated cap 5. The parts of this inner expansion chamber 3, 4, and 5 are pressed together by springs 6, and 7 is the moving switch contact which is drawn up when opening the switch. Both chambers are filled with a liquid 8 (for example, water) and on separating the contacts 2 and 7 the arc which generally forms vaporises part of the liquid. At a certain pressure, determined by the tension of the springs 6, an annular gap appears at either the upper or lower side of the plate 4 through which the vapour can escape directly into the outer chamber 1, where it recondenses. That the effect of this chamber must be most pronounced is clear from equation (4). On deriving from it an expression for the pressure drop, we obtain—

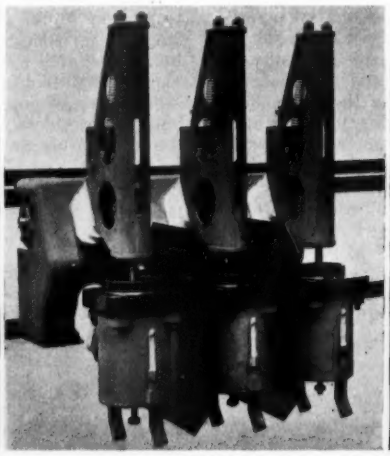
$$\left(\frac{dp}{dt}\right)_{t=0} = k\, p_0 \frac{vF}{V_0} \quad \ldots \quad \ldots \quad (6)$$

In other words, large pressure drops are associated with large values of exit area F and high exit velocities v, the latter being determined by the hydrodynamic resistances. These are quite small in the case of the arrangement depicted in fig. 10; furthermore, it is important that the vapour volume V_0 should be small, a requirement which is readily met by suitably dimensioning the chambers 3 and 5. Finally, with increasing pressure p_0 the pressure drop (and therewith the temperature drop) increases also; fig. 4 indicates, however, that there is little purpose in going beyond a pressure of 30 atmospheres as in the higher-pressure region even large-pressure variations produce very little change in temperature. In other words, at high pressures the efficiency of the circuit breaker is poor; at the same time its construction becomes heavy and expensive. For these reasons the springs 6 are adjusted for a pressure of from 15 to 30 atmospheres, depending upon the operating conditions prevailing. Accordingly the expansion chamber constructed as shown in fig. 10 realises in practice calculations based on the theory of the expansion breaker.

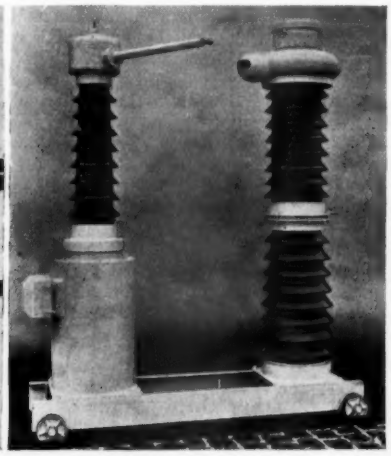
From the designs of breaker so far developed it is found that the quenching of the arc in liquids is accomplished as follows. After opening the contacts part of the liquid immediately surrounding the arc is vapourised, whilst a further part is gasified. When the current passes through its zero point the arc is extinguished and an electric field determined by the recovery voltage then prevails between the contacts, which exerts an accelerating force upon the electrically-charged particles in the arc space. Should enough free electrons be available they can be accelerated until they attain sufficient velocity to give rise to ionisation by impact. A gradually increasing avalanche of newly-charged particles is thus built up and so finally results in the re-establishment of the arc. If, however, the seizure of electrons by vapour molecules takes place more rapidly than the formation of fresh electrically-charged particles, then, in the course of time, the number of free electrons and ions will decrease. Re-establishment of the arc will thus be prevented, as the seizure of an electron by a molecule of water vapour results in the formation of an ion so large (about 30,000 times) that it can hardly



30,000 A, 10,000 V



15,000 A, 10,000 V



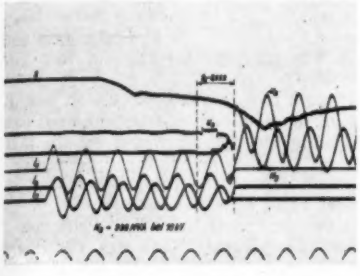
100,000 V, 1,500,000 kVA

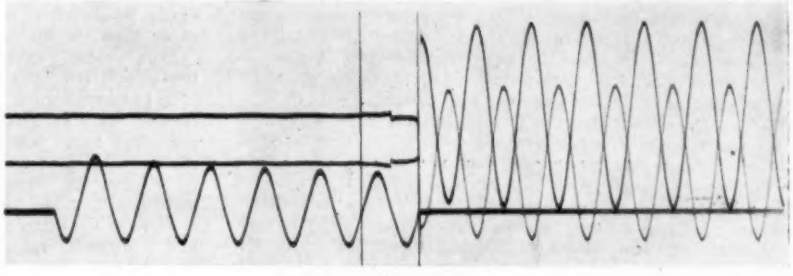
Figs. 5, 6 and 7.—Transportable, Wall-mounting, and Outdoor Types of Expansion Circuit Breakers

be accelerated any more by the electric field. In general, the process does not cease at electron seizure by individual molecules, but continues, as was shown by Wilson, until in a short time liquid particles are formed.

Constructional Arrangement.—The expansion chamber has been described (fig. 10), and fig. 5 shows the appearance of a complete breaker for 10,000 volts and 30,000 amperes. The expansion chambers and the operating mechanisms for the moving contacts are supported on L-shaped steel framework by insulators. The common operating shaft is carried in bearings at the back and is connected to the individual operating mechanisms through insulated rods. Fig. 8 is an oscillograph record of a circuit rupture, showing that the arc was quenched in 0.022 second. A second type of breaker rated at 15,000 moving switch contact. Operation is effected through the disconnecting switch carried on the same baseplate. The supporting insulator of the latter is rotated by remotely-controlled operating gear situated below it. The oscillogram of a circuit rupture at 100,000 line volts (fig. 9) shows that the arc was quenched in 0.02 second, *i.e.*, after two half cycles, thus probably being the first circuit breaker which has done so.

Operating Experience.—Early in 1930 the first expansion circuit breaker, which corresponded to the design illustrated in fig. 5, was put into operation. After the results obtained with the 1 million-kVA switchgear testing plant had been fully verified by actual operating practice, further breakers were installed in rapid sequence. Operating experience has now been obtained with some 150 of them installed in the stations





S=motion of moving contact, i_1 i_2 i_3=phase currents, U_B=arc voltage, U_2 U_3=recovery voltages.

Outdoor type, 100,000-volt line pressure.

Figs. 8 and 9.—Circuit Rupture Oscillograms (0.02 second)

amperes at 10,000 volts is illustrated in fig. 6; it can be mounted on a wall, or a steel structure, in the same way as an isolating switch, its main features being otherwise similar.

As the external construction of the expansion breaker is radically different from that of the oil circuit breaker, due to there being only one break per phase, the design of switchgear lay-outs can be approached from an entirely fresh point of view, as illustrated by figs. 11 and 12, which denote a considerable saving in building space.

The economics of switchgear lay-outs show that in the case of expansion-breaker installations outdoor equipment becomes cheaper than indoor equipment only above 30,000 volts. For this reason the new breakers for pressures of from 30 to 220 kilovolts were at first constructed for outdoor situations; fig. 7 illustrates an outdoor type for 100,000 volts which is capable of interrupting 10,000 amperes, corresponding to a rupturing capacity of 1¼ million kVA. The single-break circuit breaker proper is carried on a robust pedestal and consists principally of a multi-stage elastic expansion chamber together with operating gear for the

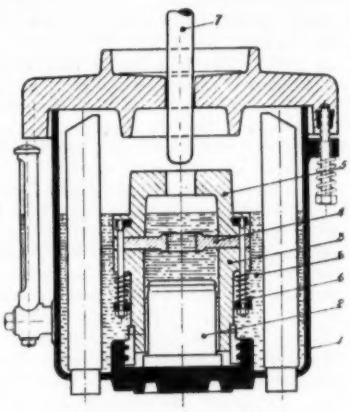
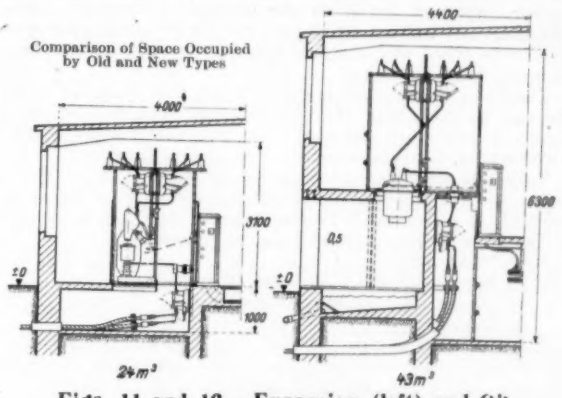


Fig. 10.—Water-filled Expansion Chamber

of 23 different electricity undertakings and, without exaggeration, its success has exceeded even its makers' boldest expectations. Loss of liquid and the burning of contacts are so small that in the case of one breaker which operated 1,800 times in six months, for example, no appreciable change in the contact surfaces could be observed. Topping-up of the expansion chambers is only necessary after 1,500 operations. As the expansion circuit breaker combines all the advantages associated with the oil circuit breaker, and as, in contradistinction to the latter, it functions in a non-inflammable (and therefore absolutely safe) quenching medium, there is reasonable certainty that in future a large majority of switchgear installations will be equipped with this apparatus.



Figs. 11 and 12.—Expansion (left) and Oil (right) Breaker Chambers

Tientsin Electricity Supply

THE report of the electrical engineer, Mr. R. A. Williams, O.B.E., B.Sc., on the working of the electricity undertaking of the British Municipal Council, Tientsin, China, for the year 1930 shows that, notwithstanding the terrible state of trade depression that existed during the year, the actual sales of electricity were higher than in 1929 by 6 per cent., and only 1 per cent. less than during the record period of 1928. Further, the sales during the last month of the year were greater than during any similar period in 1928 and 1929. The total energy sold was 7,941,722 kWh, as compared with 7,489,000 kWh in 1929. The operation of the power station throughout the year was very good. The total amount of coal used was 13,763 tons, or 3.2036 lb. per kWh generated. There were no large extensions or alterations to the distribution system during the year, and the whole system, "overhead," was kept in perfect condition, with practically no failures. The load factor of the distribution system, based on the maximum load delivered to the mains and the electricity sold, was 34 per cent., as against 32 per cent. for the previous year. There was an increase of 22.5 per cent. in the amount of electricity consumed for heating, cooking, &c., but, unfortunately, as the result of the low exchange, it was found impossible to continue the hiring of cookers imported from abroad. A number of cookers were made locally by the department, and these have given entire satisfaction in use. Further, all the heating units used to replace damaged heaters have been made in the showroom and, of some hundreds, there has not been a single failure during the past two years. The total income for the year was 535,400 taels,* and the expenditure 364,622 taels, which, after transferring a sum to the capital reserve, leaves a surplus of 128,083 taels. The capital expenditure for the year amounted to 35,938 taels, bringing the total outlay of the undertaking up to 1,197,988 taels.

The total capacity of the transformers in service at the end of the year was 5,175 kW, while the total connected load was 9,333 kW. At the end of the year there were 4,880 meters in service, of which 1,363 were tested *in situ* and found to have an average accuracy of over 99.5 per cent. The maximum normal demand on the undertaking during the year was 2,860 kW.

* 1 tael = 1s. 6d.

Domestic Water Heating

Four methods considered from the points of view of the supply undertaking and of the consumer

By A CONSUMERS' ENGINEER

SOME undertakings have for a number of years past been quietly building up a water-heating load, largely by converting to electric heating the existing hot-water systems, and have thus gained a considerable and profitable revenue, particularly in summer time. In many cases, especially where used as an alternative to, or an auxiliary of, existing fuel-fired boilers, such conversions meet the consumers' needs very well, but in others, where the whole requirements throughout the year have to be met, more efficient means have been found necessary, and the lagged thermostatically controlled type of heater has come into use.

At present most undertakings are catering in some way or other for water heating, or seriously thinking of so doing, and it is important that a clear idea should be formed, before development proceeds too far, as to what are the requirements which have to be met. The average householder now heats his water by means of the kitchen fire, or from a boiler behind his living-room fire, and generally regards it as hot water *for nothing*. If he heats water by any other means, he regards the cost of such heating as an additional cost and therefore expects better hot-water service than he has previously had. It is therefore advisable in the first place to make him realise that his present system does cost him *something*. Having done that, the advantages of heating electrically can be shown to be worth any additional outlay there may be.

Emergency Requirements

The only thing which can be advanced in favour of a raw-fuel fire is that in case of emergency it can be forced in order to give additional supplies. In a completely all-electric house, this can easily be met by bringing into service the washboiler and kettles, which together with the heater for ordinary supplies will give the required extra quantity with as much speed and less trouble than a fire can do. In a partially electrified house some difficulty may be experienced, unless care is taken when installing the heater to see that there is a reserve of hot water over and above the normal requirements. This is a rather important point, as the emergency occasions when abundant hot water may be required are generally those due to illness, when any shortage would be particularly noticed, and not easily forgotten.

There is in some quarters the tendency to look at the water heating business from the point of view that the consumer ought to make his demands meet the convenience of the undertaking, whereas the reverse should be the case.

To decide what can or what cannot be done to meet the users' needs with a profitable result to the supplier, the various methods of giving water heating supplies should be reviewed.

There are broadly four systems, as follows:—

(1) Night storage.
(2) Alternative use with some other appliance.
(3) Unrestricted use of a limited loading.
(4) Geysers.

The first three are all " storage " methods, while the latter is instantaneous. Combinations of the first three are also possible with a two-rate tariff, particularly of (1) and (3).

Each method has advantages and disadvantages, both from the suppliers' and the consumers' points of view. The problem is to select the one which for any particular undertaking gives the greatest convenience to the consumers and the least inconvenience to the supplier with regard to maximum demand.

The Undertaking's View-point

From a load-factor aspect the night-storage method is ideal. It necessitates, however, the provision of a time switch or its equivalent, at a considerable capital expenditure. A comparatively large storage vessel is also needed, and if this is to be provided by the undertaking there is additional expenditure. A booster should also be provided for emergency use at a further capital cost.

The time switch may fail to function, resulting in low-rate energy being taken during the daytime; this is not a serious matter as it would occur very infrequently, and would not upset the consumer. If a two-rate tariff is in operation, however, to cover the energy used by the booster, and the switch stays on " high " when it ought to change to " low," the consumer has reason for complaint.

The alternative-use system has many good points, the chief being that it prevents any increase in the existing maximum demand. It can, however, be applied only to a limited number of premises, where some appliance of fairly high loading, such as a cooker, is in intermittent daily use. It is not suitable to premises other than domestic. The relay or load leveller required calls for some expenditure, though not so great as for the time switch for night storage.

The unrestricted-use method has the demerit that the total loading of the heater may come on the peak. Considered individually this appears to be a serious matter, but actually, owing to diversity, it is not so. No expenditure is necessary other than for the heaters themselves. A two-rate tariff for " peak " and " off-peak " energy can be applied, but this makes a time switch necessary.

In industrial towns where a large motive-power load is connected, the combination of night-storage and unrestricted day use offers some possibilities. The former would ensure that the morning peak would not have water heating superimposed on it, and the latter would enable the consumer to obtain additional supplies towards night time if necessary.

Another variation is a two-rate tariff, in which " summer " and " winter " rates are incorporated. This has the merit that no time switch is required. It has advantages in residential areas and should be seriously considered.

Geysers, to be of any practical use, must have a high loading. The effect on pressure regulation is, therefore, bad, unless they are connected across the outers, but a three-phase geyser now available will overcome this difficulty where it can be used. It is not usual, however, to find three phases and neutral in the average dwelling house. Geysers may add seriously to the maximum demand, but here again the diversity comes to the rescue. Their diversity is better than that of any storage type of heater in a general way, but, if any number of them came on at say about ten p.m., which is a popular bath-hour, it might be bad for the particular distributor to which they were connected.

The Consumer's View-point

More space is required by the night-storage method than can usually be afforded. Should all the stored water have been used, there is no indication of the fact until the hot tap begins to run cold. As in the majority of houses, hot baths are taken at night, this is a likely and vexatious occurrence. The alternatives are to go without, or to use a " booster " at a comparatively high rate, and even then there is some delay in replenishing the hot supply. The provision of a time switch or its equivalent probably means an additional rental, which partly offsets the advantage of a low rate per kWh. Should the time switch fail there might be no hot water when needed.

Alternative use.—The times when more hot water is required than is usual are also those (such as when visitors are staying in the house) when greater use is made of the cooker or other alternative appliance; consequently apart from this there is no serious disadvantage in houses where a cooker is installed.

Unrestricted use is the consumer's ideal with which he can find no fault, provided his storage capacity and the loading of his heater are so related as to give him his maximum requirements. A reasonable tariff must be on offer. A " peak " and " off-peak " two-rate tariff is not desirable, as the running costs become a somewhat unknown quantity, and a time-switch rental is probably entailed. " A " summer and winter " tariff is not objectionable, as it is known definitely when the higher rate units are being used.

The high loading of geysers necessitates costly wiring. The risk of breakdown is greater than that of low-loaded heaters, especially in hard water districts. Even with a loading of ten kW it takes longer to fill a bath than is required when drawing from a storage vessel. The geyser will only deliver water at one point, so that it is necessary to have more than one, thus bringing up the total installation costs. Their redeeming feature is that they have no " standby " losses. This makes them suitable for use where hot water is only very occasionally required (such as in ambulance rooms), but their use for domestic purposes is very limited.

Summarising the various factors, from both points of view, it appears that the types allowing unrestricted use are most likely to give satisfaction, provided care is taken in selecting the actual type of heater. They range from heaters with a constant low loading to heaters with a comparatively high loading which are hand controlled, with medium loadings thermostatically controlled coming in between. Second place is given to " alternative use," for the reason that the consumer himself decides which appliance he is going to use at any one time, and therefore has foreknowledge if his water heater is out of circuit.

Lloyds Bank Head Office

The electrical installation affords excellent examples of both direct and indirect lighting

By D. H. N. CALEY

THE new head office building of Lloyds Bank, Ltd., has a floor space of approximately 100,000 sq. ft. It has frontages on Lombard Street and Cornhill, and there are six floors, including one mezzanine floor above the ground level, and three basements, including a further mezzanine floor. Electricity is supplied from the 3-wire network of the Charing Cross Electricity Supply Co., Ltd., and in addition a main is run from the supply company's Cannon Street sub-station. From the intake room in the second basement the 200/400-V supply is led to the main 25-panel, open-type switchboard in one section of the control room on the same level. A central 6,000-A main circuit breaker (Record Electrical Co.) is flanked on one side by the 400-V power panels, and on the other by 200-V panels for lighting, heating and power. The other section of the main control room contains the equipment for the central-heating, ventilating, and domestic hot-water systems. The control gear is arranged with admirable simplicity, and ample space has been allowed. Distinctive colours are used in this section and throughout the building for distinguishing the various services—red for heating, blue for domestic hot water, brown for telephone wiring, and so on.

In the boiler house, on the third basement level, there are five oil-fired boilers—two for heating the ventilating air-stream, two for hot-water heating, and one for the domestic hot-water supply. The boiler temperatures are controlled thermostatically. The main heating is by the hot-water panel system, and the temperatures at various points throughout the building can be shown on a Cambridge remote-indicating thermometer in the engineer's office, in which are also bull's-eye indicating lamps and remote-control switches connected with the various fan motors. This office is directly approached from the control room by a short ladder, and at the same time it is sufficiently well isolated from rotating machinery and from the boilers as to be free from objectionable noise.

For emergency lighting in the engineering section a battery for supplying forty 32-V lamps is provided. The battery is also used for supplying the call and alarm systems throughout the building. It is tapped at intervals of three cells, and the various 6-V circuits are connected to a rotary change-over switch, so that the various sections of the battery may be equally discharged.

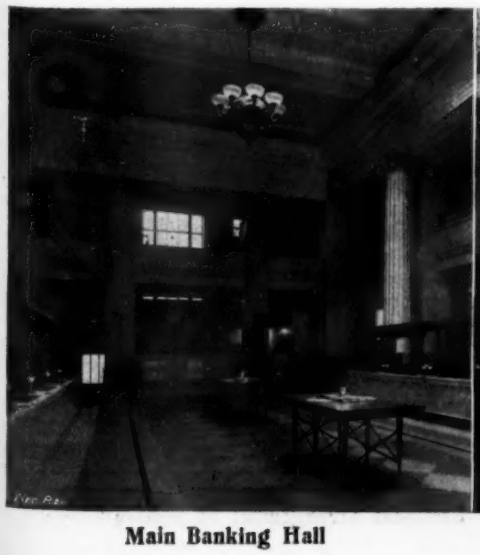
The water supply is obtained from two artesian wells by Isler borehole centrifugal pumps. These pumps are driven by 38-h.p. motors (by the Lancashire Dynamo & Motor Co.) at speeds from 1,350 to 1,550 r.p.m., and are governed by Brookhirst starters. The wells are sunk to approximately 500 ft., and the water is pumped to the roof from a depth of approximately 300 ft., giving a head of some 450 ft. The total pumping capacity is 6,000 gal. per hour, and the average daily consumption of water is 40,000 gal. Six tanks afford a storage capacity of 80,000 gal. Each of these tanks has an effective depth of six ft., and a Cambridge level indicator in the pumping chamber shows the quantity of water in each at any time.

Lloyds Bank Head Office, London

The chief point of interest in connection with the ventilation system is that the main air-washing plant is preceded by an oil-filter which is stated to render the incoming air 98 per cent. pure before it enters the air-washer. The ventilation capacity is 60,000 cu. ft. per min., and the operating temperature of the air-stream is 65 deg. F. There is also a 10,000-V Ozonair plant operated through a rotary convertor from the 400-V system. A further independent air-washing plant is provided for supplying air, either directly at outside temperature or artificially cooled, to the large city office ledger room, the air in which can be changed ten times per hour. The artificial cooling is effected by a CO_2 refrigerating plant working in conjunction with the air washer and dehumidifier. Apart from the various fan motors, the 400-V power installation includes twenty Waygood-Otis 350 ft. per min. passenger lifts, many of which operate through eleven storeys. A Relay automatic system of private telephones connects not only all the rooms in the head office building, but also the principal London branches of Lloyds Bank, the total number of lines being some 800.

A considerable amount of electrical equipment is used in the kitchen of the staff restaurant, which usually provides about 1,000 meals per day.

The architectural beauty of the building is perhaps shown at its best in the main banking hall, which stretches across the ground floor from Lombard Street to Cornhill. The illustration of a small section of the banking hall shows one of the two large pendants forming part of the lighting scheme, but the effect of the illustration is to make the fitting appear considerably smaller than it actually is. The globe forming



Main Banking Hall

The Board Room

City Office Ledger Room

the main part of each of these two fittings is of heavy cast-bronze, and each of the ten relatively small glass bowls contains a 100-W lamp. Attached to the suspension, and just visible at the top of the illustration, is a secondary lighting unit containing six 60-W lamps. Amber-coloured lamps are used in both instances. The greater part of the lighting, however, is from a laylight in the high ceiling, consisting of 42 panes, above each of which is a 200-W lamp. The main counter, of which two portions are shown in the illustration, is continuous, and along its full length is an electrically-operated conveyor belt connecting with a delivery chute to the city office ledger room directly beneath.

The city office ledger room is lighted entirely by the "Restlight" system of artificial daylight. The room measures 64 by 46 ft., and has accommodation for 150 clerks. The lighting is distributed through a large number of ceiling panels, above each of which is a 300-W lamp with a special "Restlight" reflector. The lighting load for the room is 20 kW. The heating effect of this installation is compensated by the artificially-cooled ventilating system referred to above. Where divisions in the ceiling might cause less effective illumination at the working level, the ceiling-panel lighting is supplemented by square ceiling lights of "Restlight" glass. Along the walls is a series of artificial windows, and aluminium-topped lamps are used in conjunction with concave reflecting screens of polished metal, producing an excellent effect. The room is equipped with a large number of electrical ledger posting and calculating machines, the former having 200-V motors running continuously. Plug points, close to the operator at the side of each machine, are in duplicate, with duplicate circuits, so that the operation of the machine need not be interrupted in the event of the failure of one circuit.

Another large room in which special lighting is installed is the board room, in which a ceiling panel is fitted adjacent to each window, and there is also indirect lighting from the series of upright standards. On some of the main working floors the principal lighting is largely indirect. One system embodies so-called tulip fittings. These are ornamental opal shades, open at the top, supported on wooden pedestals from the counter structures. Within the lower part of the glass fitting are five 15-W lamps, throwing a subdued light through the opal glass, while a 150-W lamp in a "Duroray" reflector illuminates the ceiling. Fittings of similar kind, but less elaborate, have been substituted for ceiling lamps on other floors, as the policy of the Bank is to experiment with a view to reducing eye-strain to a minimum. The standards used with this indirect lighting may be compared in a purely general way with those used for the indirect lighting of the escalators at Piccadilly Circus Underground station. Opinions as to the effect of this means of lighting naturally vary according to æsthetic tastes, but there is no doubt whatever that for office use the lighting provided by the dual indirect-and-direct system of this Bank is very satisfactory. Owing, however, to most of the light being reflected from the ceiling, the task of keeping ceilings sufficiently white may, in London, prove to be arduous. In some of the chief corridors on the upper floors the lighting is supplied by simple decorative glass fittings with silvered metal mounts. These fittings are close to the ceiling, but open at the top, and though their appearance is effective, there is the objection that dirt may easily enter and be somewhat tedious to remove. But the general standard of lighting is so high, and the comfort of the employés has been studied so carefully, that such minor criticisms are of small significance. In connection with the wiring system the chief point of interest is that the whole of the conduits are of copper, with junction boxes of gunmetal.

Finally, to give some conception of the size and importance of the building from the electrical standpoint, it may be mentioned that the total connected load is about 1,200 kW, and that during the winter season the usual daily consumption of energy has been between 5,000 and 6,000 kWh.

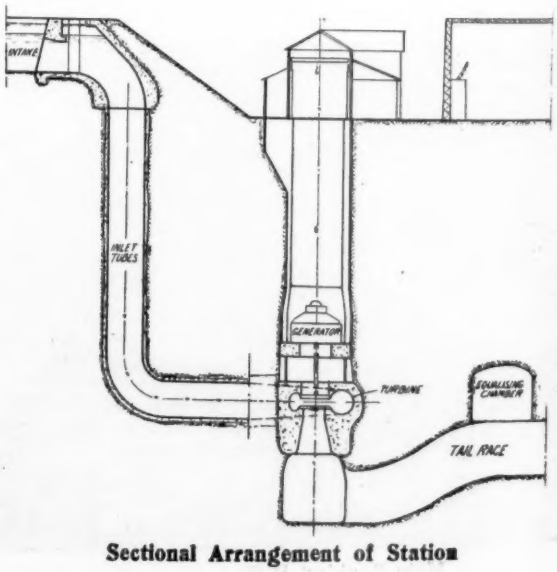
The consulting engineer for the whole of the electrical, mechanical and structural work was Dr. Oscar Faber, O.B.E., D.Sc., M.I.C.E. The architects were Campbell, Jones, Sons and Smithers; and Sir John Burnet and Partners. Acknowledgments are also due to the general contractors, Trollope and Colls, Ltd., to the electrical contractors, Drake & Gorham, Ltd., and to G. N. Haden & Son, Ltd., who installed the heating and ventilating systems. A system of electric clocks was installed by Gillett & Johnston, Ltd.

Sweden's Largest Hydro-electric Power Station

EXCAVATIONS for what will be Sweden's largest hydro-electric plant will be started shortly at Krangede Falls on the Indal River, quite near to the Hammarforsen plant described in the ELECTRICAL REVIEW of July 11th, 1930. To begin with, two vertical-shaft turbines will be installed, each unit developing 30,000 kW on a head of about 190 feet. It is ultimately intended to install 6 units with an aggregate capacity of 180,000 kW. The turbines themselves will be the largest in Sweden in respect of individual output. The turbines will be of the spiral-cased Francis type with scrolls of steel-plate, and will be fed through vertical inlet tubes; one tube to each unit. The accompanying drawing is a sectional view through one of the units.

The power station, as can be seen, will be blasted in the rock some 170 feet below the surface, and each tail-race tunnel will be some 8,000 feet long. It is calculated that 100 tons of dynamite will be required for the first installation and 600 workmen will be employed at the site.

This plant is owned by the City of Stockholm and four large industrial companies in the north of Sweden. The energy going south to Stockholm will be transmitted at a voltage of 200,000 volts, which will be the highest voltage used, as yet, in Sweden.—GEORGE WILLOCK.



Sectional Arrangement of Station

Installing New Machinery

Conditions in which it is Economic to Substitute New for Old and Less Efficient Plant

By R. S. H.

COMPARISONS have been made recently between the relative efficiencies of different concerns in Great Britain and in other countries, such as the U.S.A. and Germany; with regard to the U.S.A. in particular it has been stated that machinery is scrapped at an earlier date there than in our own country, and it has been suggested that regardless of other considerations a similar policy could be adopted with advantage by ourselves. It has also been urged that money should be spent in substituting new plant for old plant in all industries—it being assumed that it will be more profitable to scrap the old plant, that there will be no difficulty in disposing profitably of the output made possible, and that there will be no further falls in the level of prices of new machinery. Many of such arguments have not been sound, and improper conclusions have been drawn from comparisons which have been incomplete or misleading.

Quite apart from such current discussions, the rise in the cost of wages as compared with the cost of capital charges on machinery, the general growth of output, and the birth and development of new inventions and methods (making it become profitable to perform an increasing amount of work by the use of machinery of heavy original cost and long effective life) make the question of the installation of new machinery a matter of growing importance in industrial management.

Fixed and Running Costs

The ultimate basis of any such series of considerations must be costs. The costs of production in any industrial establishment may be subdivided into two parts: (*a*) "fixed costs," the total amount of which does not vary with the output, and (*b*) "running costs," the total amount of which varies exactly with the number of units of output in any period. These costs might be subdivided as follows:—

(*a*) *Fixed Costs.*

(1) Interest on (*a*) the expenditure incurred in acquiring and installing all capital assets required for the establishment in question, and (*b*) working capital.
(2) An allowance for the depreciation and obsolescence of these assets.
(3) Management and any other expenses (such as local rates) not varying with the total output.

(*b*) *Running Costs.*

(1) The cost of materials consumed in preparing the final products of the establishment.
(2) Wages and other expenses of preparing the final product.
(3) Provision for the cost of repairs, maintenance, and renewals sufficient to keep all capital equipment at full productive efficiency.

With regard to the suggested division between fixed and running costs it is desirable to point out that not the whole of the expenses enumerated are necessarily fixed or running costs as shown—in fact in some industries a quite important proportion is in each case properly regarded as appropriate to the other category. For instance, where the capital equipment is static and is exposed to the elements a quite substantial proportion of the cost of repairs may often be properly regarded as fixed costs. For instance, it is easy to imagine that in this country much of the cost of railway permanent way renewals may be attributed to the weather, quite apart from wear by rolling stock. Similarly, the greater part of the cost of repairs to buildings and telegraph lines is a fixed cost—that is, it does not vary with the output or use made of the asset. This question of allocation is often difficult to determine and must be a matter for each individual industry or process.

Capital, and Operation Charges

Electricity supply engineers will be familiar with the official Statutory Order called for by the Electricity Supply Act of 1926, Statutory Rules and Orders, 1929, No. 1015, which sets out (by means of algebraic formulæ for some expenses such as repairs and maintenance) a method of allocating the costs of production in electric power stations between fixed and running costs which is to be used in practice.

The allowance for the depreciation and obsolescence of capital assets included under fixed costs is necessary to meet the following contingencies:—

1. A falling off in the sale of the product of the establishment in question due to—
   (*a*) Increased sales by other manufacturers with the same basic costs.
   (*b*) The invention or increased use of substitutes.
   (*c*) A change in fashion.
2. The sale of new equipment of lower overall output cost through either lower annual capital charges or lower running cost, or through some combination such that other manufacturers are able to compete on more favourable terms.

The amount of any such allowance can be at the best only an educated guess as to what is necessary and this may be upset in many ways; it is as well to be on the safe side, as any excess provision will in time become apparent and will be available for distribution as additional profit, but, if insufficient provision has been made, awkward results may follow.

With regard to the expenditure on repairs, maintenance, and renewal of capital equipment, it is certain that if sufficient expenditure be incurred it is possible for any unit of equipment to operate at full efficiency over an indefinite number of years, although after a time none of the original materials may remain. In this connection the writer recollects having read a year or two ago that there had been scrapped for a cheaper electric motor a steam engine which had been in use for something like 120 years. As a matter of fact it is not unusual for a machine to be more efficient after a lapse of time than when it was new, for it is possible to substitute superior materials for those parts which wear most rapidly while at the same time the design can often be modified in minor respects as deficiencies are observed. The cost of repairs is often not level year by year, but it is usual to smooth out the incidence by accumulating a reserve fund.

Overall Costs of Production

To return to the allocation of costs of production, it is obvious that the overall costs per unit are at their lowest when the output for any given amount of fixed costs is at a maximum for the amount of fixed costs per unit of output is then at a minimum; that is, the establishment in which the plant runs at full capacity for the largest number of hours in any year will have lower overall costs than competitors with the same basic costs and plant capacity. In the electricity supply industry the ratio of the output from an establishment to what would have been the output if all the plant in use had been run continuously at full capacity for every hour in any period of time is known as the "load factor," a term which it is proposed to use in this article. It is doubtless clear to all readers that if through the nature of the business or by luck in bargaining an establishment recovers all its fixed costs by the sale of only a part of a year's output, it will be profitable for that undertaking to sell the rest of the year's output at a considerably reduced price, provided that price is at its lowest slightly above the running cost per unit of output. It is by such differentiation of charges that there takes place on the one hand what is known as "dumping" in foreign trade, and on the other the variations in charges according to the time of the day, week, or year, now experienced with regard to such concerns as railway, tramway, electricity supply, or even picture-theatre establishments. By selling at a price below the running cost per unit an establishment would reduce its net profit and this would not be tolerated except as a temporary advertisement.

The Adoption of New Plant

The circumstances in which the question arises whether or not new plant shall be installed in an industrial establishment may be subdivided as follows:—

1. The marketing of machinery which gives a lower cost of production per unit of output than existing methods; these may include the use of old machinery with a higher cost of production.
2. Increase of anticipated profitable output from the establishment beyond the capacity of existing installations.

The issue should be decided on relative costs; much will depend, of course, on the output which the plant will be used to produce and an estimate of anticipated disposable output must be made. Let us assume that the anticipated output is within the capacity of existing installations (the same main considerations apply if the anticipated output is beyond the capacity of existing installations). Suppose that annual fixed costs with old methods amount to £F_o capital charges and £F_o, other fixed costs giving an annual total of £(F_o+F_o). Suppose the running costs per unit of output amount to £n

per unit; then the total cost of production per unit assuming U units output per year is

$$£\left(\frac{F_e + F_o}{U} + R\right).$$

Now assume that new plant is adopted and that the capital charges on the new additional capital expenditure amount to $£f_e$ and that the other fixed costs amount to $£f_o$. The new capital expenditure will include the cost of acquiring, installing, and housing the new plant, plus the cost of removing any old plant less any receipts from the sale of such old plant as has been scrapped. From the time when the new plant is installed the annual fixed costs amount to $£(F_e+f_e+f_o)$ for the capital charges on the outstanding cost of any old plant are still payable even though the plant be scrapped. Now assume that the new average running cost, the plant available being used in the most advantageous way possible, is $£r$ per unit then, with an annual output of U units, the total cost of production with the new plant amounts to

$$£\left(\frac{F_e + f_e + f_o}{U} + r\right)$$

per unit. Unless this cost of production is below that with the old methods there is no case in favour of the installation of the new plant as regards costs. The comparative costs per unit are:—

With new plant $£\left(\frac{F_e + f_e + f_o}{U} + r\right)$,

and by old methods $£\left(\frac{F_e + F_o}{U} + R\right)$.

The capital charges on the outstanding cost of the old plant ($£F_e$) occur under both conditions; at the same time other fixed costs ($£f_o$ and $£F_o$) will not differ substantially, for in most industries they would be made up of such expenses as salaries and insurances which in general would not vary to any great extent with a change in plant; it is thus possible to eliminate these expenses from both sides giving the following comparative figures:—

With new plant $£\left(\frac{f_e}{U} + r\right)$

per unit, and old methods $£R$ per unit, or (to compare total costs assuming U units of output)

$£(f_e + Ur)$ $£(UR)$.

In other words, unless the total of the additional capital charges due to the acquisition and installation of the new plant together with the running costs of producing the contemplated output with the use of the new plant is less than the corresponding running costs with old methods, it is not profitable to instal new plant.

In this connection most readers will know and it is of interest to record the fact that under Section 14 of the Electricity (Supply) Act, 1926, it is laid down that before a local electric power station can be closed down in favour of a purchased supply from the "Grid" lines of the Central Electricity Board it must be proved to the satisfaction of the Electricity Commissioners that the cost of such a purchased supply is lower than the cost of local generation excluding capital charges, a ruling which accords with our arguments.

It will be seen that the decision as to whether or no new plant shall be installed depends to some considerable extent on two most indefinite elements (*a*) the number of units of output which it will be possible to sell at a profit, (*b*) the rate of provision for depreciation obsolescence; it would appear that in times of depression it is not unwise for industrialists to be gloomy rather than optimistic with regard to these elements, for it is quite possible that the capital cost of new machinery will fall with the adjustment of costs to new conditions.

Carrying Capacity of Cables

THE tables of current-carrying capacities given below are based entirely on heating effects. In most cases, however, the voltage drop and power loss in the cable will also have to be considered. For cables in the ground and in air, and for other similar combinations the rating should be checked for each section, *i.e.*, the cable will run hotter in the section in air. The ratings given are for continuous loading; for intermittent loading they may be increased slightly, depending on the time cycle, and for lighting circuits about 5 per cent. may be allowed.

With rubber cables for wiring buildings having a cross-sectional area less than 0.007 sq. in., the current density is based on 4,000 A per sq. in. Above 0.007 sq. in. up to 1.0 sq. in. the temperature rise is based on 20 deg. F., with an air temperature not exceeding 80 deg. F. In the case of a higher air temperature the normal maximum temperature should not exceed 120 deg. F., or 130 deg. F. for short periods.

The normal temperature of paper-insulated lead-covered cables for wiring buildings where the air temperature does not exceed 80 deg. F. should not exceed 130 deg. F., allowing 50 deg. F. rise. For cables designed for a pressure not exceeding 660 volts the maximum permanent temperature should not exceed 176 deg. F., this figure allowing a margin of 46 deg. over the normal temperature rise.

In the case of cables as above for building wiring, the further limitations due to voltage drop imposed by the I.E.E. regulations must be followed.

The use of cambric-insulated cables is convenient for machine and transformer connections in sub-stations, &c., as no provision has to be made for sealing. The ratings of cambric cables as regards temperature rise may be obtained from Table II. Lead-covered and armoured cables laid direct, plain lead in ducts, and plain lead in air have the same rating as equivalent paper-insulated cables. For plain braided-cambric cables in air take figures in column C and multiply by 0.9.

TABLE I.

Nominal Area.	One Single Cable.				One Three-core Cable.			
Sq. in.	A	B	C	D	A	B	C	D
.007 ...	60	37	38	45	40	27	27	30
.01 ...	79	48	49	59	52	35	36	40
.0145 ...	100	60	62	73	66	44	45	50
.0225 ...	131	78	80	96	84	58	59	66
.03 ...	155	92	95	112	98	68	70	78
.04 ...	190	114	117	138	120	86	88	97
.06 ...	248	153	157	180	154	113	116	126
.075 ...	285	180	184	209	176	132	136	145
.1 ...	337	213	219	249	208	161	165	176
.12 ...	367	237	243	273	226	177	181	192
.15 ...	415	275	283	324	260	207	213	222
.2 ...	492	334	342	387	305	252	259	267
.25 ...	558	393	403	446	349	294	302	309
.3 ...	627	451	464	509	391	337	346	352
.4 ...	745	554	569	613	460	412	423	425
.5 ...	835	636	654	700	520	474	487	487
.6 ...	942	733	754	797	—	—	—	—
.75 ...	1,055	842	865	910	—	—	—	—
.85 ...	1,140	920	950	990	—	—	—	—
1.0 ...	1,282	1,065	1,092	1,130	—	—	—	—

Table I gives the current-carrying capacities of low-voltage paper-insulated cable, both armoured and unarmoured, allowed by W. T. Henley's Telegraph Works Co. Column A refers to lead-covered armoured cable laid direct; B to lead-covered unarmoured cable laid in ducts; C to lead-covered cable in air; D to lead-covered and armoured cable in air.

The conditions on which this table is based are: for col. A, situations where soil temperature does not exceed 60 deg. F., temperature rise 90 deg. F., cables up to 2,200 volts laid 18 in. deep, and above 2,200 volts 36 in. deep; for col. B, where duct temperature does not exceed 60 deg F. and temperature rise 63 deg. F.; col. C, where air temperature does not exceed 80 deg. F. and temperature rise 60 deg. F.; and col. D, as for col. C. The columns covering one three-core cable also cover four-core and twin-concentric cable.

The correction factors in Table II will enable the data given in Table I to be used in connection with cables of all voltages, and also covers the variable factors such as grouping of cables, temperature range, the use of shaped conductors, &c.

To obtain the correct carrying capacity for any given conditions, the figure obtained from Table I should be multiplied by the appropriate factors obtained below.

The letters A, B, C, D below refer to the types of cables allocated the same reference letters in Table I.

TABLE II.

Correction for Voltage.

Voltage.	2,200	3,300	6,600	11,000
A ...	.98	.97	.95	.94
B and C ...	1.01	1.07	1.08	1.10
D ...	.99	1.04	1.04	1.02

Correction for Grouping of Cables.

No. of Cables.	2	3	4
A 4″ crs.	.76	.7	.65
12″ crs.	.87	.8	.75
24″ crs.	.93	.9	.85
B	.8	.75	.7
C & D	.9	.85	.8

Correction for Shaped Conductors.

Voltage.	660	2,200	33,000	11,000
All letters ...	1.04	1.03	1.02	1.0

Correction for Soil Condition.

	Very dry.	Very moist.	In water.
A	.85	1.15	1.3

Correction for Initial Air Temperature.

Degs. F.	50	68	86	104	122
C & D ...	1.225	1.095	.95	.775	.55

Correction for Initial Temperature of Duct.

Degs. F.	50	77	86	95
B	1.07	.85	.75	.66

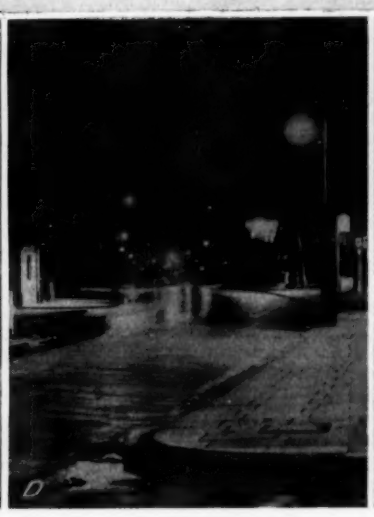
Correction for Initial Temperature of Ground.

Degs. F.	50	68	77
A	1.05	.95	.9

These correction factors are due to W. T. Henley's Telegraph Works Co., Ltd.—H. E. Hutter.

Street-lighting Improvements

Marked Gains in Illumination Efficiency have been effected by the adoption of the Asymmetric System of Lighting in the Royal Borough of Kensington



THE street lighting within the Royal Borough of Kensington is being improved by the adoption of "Wembley" lanterns equipped with asymmetric refractors, two important thoroughfares being already completed, *viz.*, High Street and Holland Park Avenue. The above comparative illustrations of the old and new lighting systems, reproduced by permission of the borough engineer and surveyor, Mr. Edwin J. Messent, afford an interesting comparison.

The high-intensity lighting which now prevails is largely due to the fact that improvements in the technique of lamp manufacture permit the use of totally enclosed non-ventilated lanterns, with the result that the latter are practically dustproof, with consequent higher efficiency of the light source. The asymmetric system provides light up and down the street, or at an angle to the length of it, rather than in a circle, thus resulting in an increased intensity midway between standards where the illumination is sometimes of a comparatively low order.

A is reproduced from an untouched night photograph taken in fine weather of the street lighting at Holland Park Avenue before the new system was installed. The new lighting at the same position and under similar conditions is depicted in B, from which it will be noted that the whole surface of the roadway is well illuminated, with an almost total absence of shadow, except at spots along the kerb edge on the right caused by the obstruction of the lighting of the roadway by the trees.

The illustrations of the lighting in High Street are equally instructive. C shows the old lighting in fine weather; D the new lighting after a heavy downfall of rain; while E is reproduced from a photograph taken under fine-weather conditions with the new lighting. In illustration E the roadway in the distance is shown to be illuminated evenly and with good intensity. D shows less distance owing to the greater concentration of reflected light from the wet surface area near the camera. This illustration is valuable to the extent that it disposes of the theory that a wet surface aided by reflections is better lit at ground level than a dry surface. The utmost that can be argued is that on a wet surface there is a greater reflective area, and that the light on the roadway is dissipated by reflections and directed and wasted on surfaces other than that of the actual roadway. The point is well worthy of note, as a wet surface does not give a true indication of the lighting that obtains on a roadway under normal conditions. The new equipment referred to was supplied by the General Electric Co., Ltd., and a brief technical description of the "Wembley" asymmetric reflector was published in the last issue of the ELECTRICAL REVIEW, p. 829.

Profits

How Advantageous Purchasing may obscure the Position

By A. W. WILLSMORE, F.R.Econ.S.

IF you were to tell the average business man that he does not know what profit he is making on his manufacturing and selling activities he would laugh at you. And yet in nine cases out of every ten you would be perfectly correct. A manufacturing company can show a very satisfactory net income for a year in which it was actually manufacturing at a loss. Conversely, profitable manufacture is quite consistent with a loss on the profit and loss account. On the face of it, this looks like a contradiction in terms but an examination into the fundamentals of the problem will indicate that it is quite true.

The essence of the situation is that net profit in the usually accepted sense of the term means the excess of all income over all outgo. It consists of a great number and variety of excesses and deficits, only one of which is the manufacturing profit, and there is usually no means of determining the actual "make up" of the net overall figure. To illustrate this idea we might take the simple case of a copper wire drawing plant. For a series of years this particular concern might have shown a satisfactory net profit on its balance sheet and have paid the usual dividends on the invested capital. Does this mean that the concern has been manufacturing at a profit? On the face of it, that is the only conclusion to draw, and yet an examination into the fundamentals of the position might bring out the fact that the particular company was blessed with the possession of a particularly clever purchasing manager. Through this individual's foresight the company might have been particularly fortunate in "anticipating the market," and when we really got down to rock bottom we might find that the whole of the substantial net profit had been obtained by purchasing copper at a low price and selling it later (in the form of wire) at a higher price. That is to say, the position might be that the company was actually drawing its wire at a loss and yet was able to show a profit by obtaining its material cheaply.

A Hypothetical Example

To make this situation more clear it might be advisable to bring a few figures into the argument. Let us assume that the wire-drawing plant in question has an output of 100 tons of wire a year, and that, including depreciation of machinery, labour, overhead and selling expenses (but *not* raw material), it is costing the company £100 to draw a ton of wire. Let us call this firm A, and consider another wire-drawing firm B, representing the wire-drawing industry as a whole, which also has an output of 100 tons but draws its wire at a cost of £90 per ton. The manufacturing activities of firm A under these conditions cost it £100 per ton for 100 tons or £10,000, while the activities of firm B involve £9,000, representing 100 tons at £90 per ton. It will be obvious that if both concerns buy their raw material at the same prices, firm B will have an advantage of £1,000 over firm A, and, for instance, if firm B makes a net profit of £1,500 then firm A can only make a profit of £1,000 less than this, or £500. But firm A, as we have found, has a particularly shrewd purchasing manager and buys its copper at advantageous prices. How does this affect the comparison of its profits with those of firm B?

How Purchases Affect Profits

Under modern conditions of competition in industry, customers have quite a good idea of what it costs to produce the goods in which they are interested. In this particular case they would know that the average price of producing wire was in the neighbourhood of £90 per ton. They would have acquired this knowledge either by a study of competitive offers submitted against their inquiries or even perhaps by making a private economic study into what it would cost them to produce their requirements themselves. After making an allowance for profit to the producer, therefore, they would expect to obtain their wire at somewhere between £95 and £100 over ruling metal prices and for the sake of argument we will assume that they would be prepared to pay £100 per ton over raw material price. With copper at £60 per ton they would pay £160 per ton for copper wire and so on. It will probably be apparent at this stage how the price at which wire-drawing plant A or B purchases its raw material affects its profits.

Let us assume that for the particular period under review the average price of copper is £60 per ton. The total price which firms A and B would each get for their 100 tons output would therefore be 100×(£60+£100), which equals £16,000. Firm B has an ordinarily efficient purchasing department and pays an average price of £60 for its copper requirements. Its manufacturing cost is £90 per ton, making a total cost of £150 per ton of output or a total of £15,000 for the entire output against £16,000 sales. Firm B would then show a net profit of £1,000. On the same basis, if firm A paid an average price of £60 per ton for its copper its total cost would be £60+£100 per ton, and with a total cost of £16,000 for its output it would show no net profit at all. As we have seen, however, firm A employs a very shrewd purchasing agent and as a result it might only pay an average of £45 per ton for its copper requirements. On this basis its cost per ton of output would be £45+£100 or £145, which with an output of 100 tons would give a total profit of £1,500. Although firm A cannot manufacture at an economic price, therefore, it makes a profit of £1,500, where firm B, an efficient manufacturer, makes only £1,000.

Manufacturer or Merchant?

It will probably be admitted at this stage that the total profits of a concern do not necessarily have any relationship to manufacturing efficiency. But the question will probably be asked: "Does it matter whether a company makes its profit on manufacture or on purchasing so long as it does make a profit?" The answer is that it does matter a great deal. In the first place, a company in the position of firm A has no right to remain in the wire-drawing business. On the strength of the skill of its purchasing agent the company should sell its manufacturing plant and set up as a dealer in metals. But apart from this, without information on this point, the company has no real knowledge of whether or not its manufacturing facilities are carried out at a loss or a profit, and is therefore ignorant whether any improvements are needed. Under the illustration we have chosen, firm A, on finding out that no profit was being made on the manufacturing side of its activities, would make an investigation to discover why it could not draw wire as cheaply as its competitors. This would probably indicate appreciable savings and the concern would be able to bring its costs down to competitive levels with a consequent increase in total profits.

Distinguishing Purchasing from Manufacturing Profits

The question is: How is a company to separate profits on purchasing from profits on manufacture? The solution in the ideally simple case we have chosen would not be hard to find. The company would only have to keep a record of the price at which it purchased its materials as compared with the market price at the time it made its sales, to be able to see what price advantage it had secured, but in a large engineering shop the solution does not stand out so clearly. In such a concern the solution is to set up a materials adjustment account. The way that purchasing profits and losses get confused with manufacturing profits and losses is that in costing each particular job the material used is charged at the price which the company paid for it. To get a true picture, instead of doing this the material should be charged to the job at the current market price and any difference between that price and the price which the company paid for the material should be debited or credited to the materials adjustment account. That is to say, if copper was bought at £40 per ton and a ton of copper is used on a job when the market price stands at £50 the cost record should be charged £50 and the material adjustment account credited with that sum, and, to complete, the entry inventory should be credited with the cost price figure of £40 and the material adjustment account debited with that figure. In this way a separate profit and loss account for the purchase and sale of material is obtained and any excess or deficit can be included separately in the final profit and loss account with the actual profit or loss on manufacture. It is not, of course, intended that this should be applied to cover all the raw material that the company uses, but the principal items of material used should certainly be handled in this way if the company is interested in whether or not it is really conducting its manufacturing operations at a profit.

Electric Vehicles for Dust Collection

As is the case in this country, electric vehicles are being increasingly used in France by municipal authorities for dust-collecting purposes. Among the French towns in which such vehicles are used for this purpose are Bourges, Mulhouse, Nogent, Reuil, Tours, and Villeurbanne, while they are now about to be adopted in the town of Valence.

The Societies and their Doings

This week a telegraph pioneer is commemorated, the economics of trolley-'buses are outlined, synthetic insulating materials are considered, and the I.E.E. annual meeting is reported

The David Hughes Commemorative Discourse

THE centenary of the birth of David Edward Hughes was marked by a commemorative discourse at the INSTITUTION OF ELECTRICAL ENGINEERS in London on May 14th.

MR. C. C. PATERSON, president, read a cablegram from Dr. Elihu Thomson (U.S.A.), who sent "congratulations on the very fitting commemoration of Hughes, whose valuable work I well remember." Fortunately, said the president, there were others present at the meeting that evening who remembered Hughes and his work.

MR. SYDNEY EVERSHED then delivered the lecture in his delightfully entertaining manner, remarking that, as a young man, he had reconstructed many of Hughes's experiments. David Edward Hughes was born in London on May 16th, 1831. His grandfather was a bootmaker, and when David was seven years old his father migrated to America, taking his family with him, and settled in Virginia. Being of Welsh descent, Hughes was naturally musical, and at the age of nineteen had been appointed professor of music in St. Joseph's College at Bardstown in Kentucky. At twenty he was giving lectures in the college on natural philosophy. At the age of twenty-one Hughes was, in his spare time, inventing a printing telegraph of his own, and in 1854 he resigned his teaching appointments to devote himself to his invention, and a year later he had a trial instrument working successfully. Hughes departed entirely from the step-by-step principle. He devised a method of synchronous working between a revolving arm at the sending end of the line and a revolving type-wheel at the receiving end. Hughes, being familiar with musical instruments, thought he could not do better than employ the keys of a pianoforte, arranging the black and white keys side by side alternately in the keyboard. It contained features of striking originality, and in 1856 was adopted by the American Telegraph Co.; within a few more years his type-printing telegraph was at work all over Europe.

The Late Prof. D. Hughes

It is one thing to make a successful invention, and quite another to get paid for it, but Hughes saw to it that he was paid, and well paid, and when he returned to England in 1875 to settle down in London he was well on the way to making a large fortune out of his printing telegraph. He then entered on the second period of his life, and at the age of 44, with ample means, he found leisure for the work he loved best—experimental research. With the aid of a couple of Bell telephones, which he made with his own hands, he was soon engaged in the lengthy series of experiments that ultimately led him to the microphone. In 1878 he prepared a paper on "The Action of Sonorous Vibrations in Varying the Force of an Electric Current," which was read for Hughes by Professor Huxley at a meeting of the Royal Society on May 8th, 1878. Hughes remarks on the extreme sensitivity of the simplest form of microphone, the three rods (French nails or carbon sticks). In this form, he says, "the microphone will do for faint sounds what the microscope does for human vision."

His experimental note-books of this later period have survived, having been presented to the British Museum by Mrs. Hughes after her husband's death. They make interesting, but difficult, reading, and from them we learn that early in 1879 Hughes was engaged in experiments with his induction balance. This ingenious instrument excited great interest at the time, but had a very limited field of utility.

At that same time Hughes was led by the accident of a bad contact in an induction balance into experiments which made him acquainted with strange and confusing phenomena. The result was a prolonged investigation which, for want of light, brought no harvest. However, what Hughes thought is not so interesting to us as what he did. In one or two of his rough sketches there is something which looks like a conventional representation of a microphone, and from this and other evidence there can be no reasonable doubt that Hughes was making use of a microphone with metal contacts which had lapsed into the non-conducting state, and by so doing had become a coherer. In his notes he refers to his "thermopile" as "a new instrument of research," and if it contained an effective coherer it certainly was so. This research gave rise to a good deal of misunderstanding, both at the time and long afterwards.

Hughes was elected a Fellow of the Royal Society in 1880, and in 1885 he was awarded the Society's Gold Medal. He had been a member of the Institution of Electrical Engineers for some time, and in 1886 he filled the office of president. His later years were occupied, not only with research work, but with various activities in the scientific world, and then, after a short illness, the end came on January 22nd, 1900 (see ELEC. REV., February 2nd, 1900, pp. 185-6). By his will (see ELEC. REV., March 16th, 1900, p. 442) he left, in all, a large sum to scientific societies both here and in France, the Hughes Scholarship of the Institution of Electrical Engineers being among these bequests. The greater part of his large fortune was left to four London hospitals. From his earliest days Hughes had been accustomed to frugal living, and when his printing telegraph made him a rich man, he showed no desire to change his mode of life.

PROF. E. W. MARCHANT, proposing a vote of thanks, remarked on the tendency to forget what the old scientists had done; therefore the address was not only good in itself, but was also an encouragement to all the younger members of the Institution whose work to-day might possibly appear to have little practical value, but which in time might become almost as important as those about which they had heard that evening.

MR. W. M. MORDEY seconded the vote, and said he knew Hughes well. He really discovered Hertzian waves. Subsequently Hughes said that as young Marconi was doing really useful work, he himself would not say he had done it all before, which was typical of the kind of man he was. He also discovered the surface effect of alternating current in wires, which was remarkable, since he was working with wires of extremely small size in which the effect was almost negligible.

Trolley Omnibuses in Urban Transport

THE paper read in London before the OMNIBUS SOCIETY by MR. H. WATSON reveals the fact that over 1¼ million pounds has been invested in electric trolley 'buses. Last year they carried 108 million passengers for a revenue of two-thirds of a million pounds. There are over 136 miles of route and nearly 400 'buses in service. The economic sphere of the trolley 'bus is sandwiched between that of the petrol 'bus for the lower frequencies of service, or light traffic, and that of the tramcar for the highest frequencies of service, or the heaviest traffic.

The sphere of rail transport on streets has now become greatly restricted, the intensification of traffic making tramways more objectionable in narrow streets; but the sphere of electric traction in urban transport has not been greatly curtailed by the modern petrol engine, owing to its high running cost and poor acceleration with gear changing. Thus a natural sphere arises for an electric 'bus, *i.e.*, a vehicle to enjoy the valuable advantages of electric traction for frequent-stop service in urban areas without the disadvantages of tramways and petrol 'buses. Economic considerations are almost invariably of predominating importance; fortunately, high-grade transport can be cheap transport, and the trolley 'bus will give both cheap and high-grade transport in many towns. The following comparative estimates for a hypothetical set of conditions compare three systems from a municipal point of view, in allowing for road costs which the municipality must meet sooner or later, for a very frequent service (3 minutes) for vehicles capable of carrying up to 75 passengers, *e.g.*, a 4-wheel 62-seat tramcar and a 65-seat 6-wheel 'bus; with standing passengers they both have much the same total capacities.

Pence per 'bus mile.			Trolley-'bus.	Petrol-'bus.	Tram-car.
Traffic expenses	...	...	6.5	6.5	6.5
General	,,	...	1.0	1.0	1.0
Power	,,	...	1.9	3.2	1.6
Repairs	,, ('buses)	...	2.0	3.0	1.3
,,	,, (overhead)	...	.35	—	.2
,,	,, (track)	...	—	—	.6
Tire	,,	...	1.0	1.0	—
Tax	,,	...	.65	.65	—
Working	,,	...	13.4	15.35	11.2
Interest and depreciation	('buses)	...	1.9	2.4	1.1
,,	,, (overhead)		.2	—	—
,,	,, (track)	...	—	—	3.1
,,	,, (buildings)		.2	.2	.2
Cost to Transport Department		...	15.7	17.95	15.6
Debit or credit for road maintenance			.5	.5	1.1
Cost to Municipality		... ...	16.2	18.45	14.5
Ratio		... ...	100	114	90

The figures assume costs of £2,200, £2,100, and £2,200 for the vehicles in the order shown, a life of 10, 7, and 21 years, 5 per cent. interest, 5 per cent. sinking fund for depreciation, 10 hours service per day per vehicle, or 36,500 miles per year, a speed of 10 m.p.h.; tramways costing £28,000 per route mile, life of rails 10 years, reconstruction cost of £16,000 per route mile, electricity at 1d. per kWh, and petrol at 1s. 1d. per gallon.

D

Comparing the trolley 'bus and petrol 'bus, the electric vehicle, as a modest claim, makes a saving of 2½d. per mile, or 12 per cent., amounting to nearly £350 per 'bus per year, or over £2,000 per mile of route per year with this frequent service—typical of tramways in large cities. With a six-minute service the trolley 'bus costs are but a farthing more than at 3 minutes and the annual saving per mile of route is at least £1,000. In a large town, needing 100 trolley 'buses, the saving, if put at only 2d. per mile for 30,000 miles per 'bus year, amounts to £25,000 annually.

The progress made with the petrol 'bus discounts to some extent the various claims made for trolley 'buses in respect of speed, comfort, safety, reliability, and silence, but, nevertheless, the advantage is still with the electric 'bus, while from the economic, municipal, and national aspects, it will be much the better proposition in a great many towns, and the savings in operating cost alone well worth the nuisance of overhead gear and slightly restricted mobility.

In comparison with efficient modern tramways constructed at present-day prices, even with frequent services of about 3-minute intervals, the trolley 'bus will not cost more, or at least only slightly more, to operate.

The true sphere of the trolley 'bus is the large British industrial town, where economy is important, frequency high, electricity cheap, and æsthetic considerations of small importance. It is not to be recommended for (1) small towns, as these conditions do not apply so much; (2) interurban service, as the frequency is too low and the speed is likely to be restricted; (3) high-class residential towns, owing to æsthetic objections and public antipathy; (4) large cities, as entailing greater cost, greater danger, less stable running costs, and a lower standard of comfort and speed in bad weather on present-day roads as compared with tramways; (5) express service, owing to limitations of speed and inability to circumvent other electric vehicles; (6) very complicated traffic conditions with high-frequency services, owing to restricted mobility.

The I.E.E. Annual Meeting and Report

THE fifty-ninth annual general meeting of the INSTITUTION OF ELECTRICAL ENGINEERS was held on May 14th. The Council's report records an increase in membership of all classes of 470 to a total of 14,670, the average annual increase having been just over 522 for the last ten years; 83 deaths are recorded.

Technical libraries have been established at seven local Centres, which continued to flourish, as did also the wireless, meter, and students' sections, the last-mentioned having established a quarterly journal. The seven Faraday lectures were attended by an audience of 3,200, of whom 2,000 were non-members. New Ferranti, Duddell, and Silvanus Thompson scholarships have been established. National certificates (740 in England and Wales and six in Scotland) and diplomas (24 and 15) were issued in association with the Board of Education after examinations in 128 courses.

The extension of the activities of overseas Centres is being considered, and also the formation of local wireless sections in Canada in co-operation with the Engineering Institute of Canada.

During the year 638 books and pamphlets, including a collection of 324 works bequeathed by the late Mr. A. A. Campbell Swinton, were presented to the reference library and 109 volumes have been purchased. The total number of readers for the year was 4,359, of whom 336 were non-members, as against 6,018 and 305, respectively, in 1929-30. Some 75 new volumes were added to the lending library and 2,444 books were issued to 938 borrowers, the corresponding numbers for the previous year being 2,462 and 949, respectively.

The very slight interest taken in *Science Abstracts* by the general body of members is a considerable disappointment to the Council. Out of a membership of some 14,600, fewer than 1,500 subscribe, only 845 subscribing to both sections.

The proposed set of Model Conditions "E" for the supply and laying of cables at home have been presented to the Council; interested Associations have been invited to submit their views before the conditions are published. The Wiring Regulations Committee is engaged on the revision of the ninth edition of the Wiring Regulations, collaborating with the Committees of the Australian Commonwealth Engineering Standards Association and the New Zealand Public Works Department, which are revising the regulations in force in those countries.

In May, 1930, the observations of the Electricity (Supply) Regulations Committee on the proof of the Electricity Commissioners' new Code of Safety and Supply Regulations were submitted to the Commissioners. The new Regulations have not yet been published, but it is understood that Regulations dealing with "Insulation or Protection," "Underground Shafts, &c.," and "Service Lines into Consumers' Premises," will shortly be published apart from the main body of the Regulations.

The Committee of Management of the Benevolent Fund of the Institution reports that the total assets amount to £18,336. The donations and subscriptions to the fund in 1930 amounted to £2,587. Some 98 grants were made to 31 persons, amounting to a total of £1,465.

In August, 1929, the Council received intimation from the Board of Inland Revenue that, as the result of two test cases decided in the Courts, the exemption from income tax which the Institution had enjoyed in the past would in future be disallowed. The Special Commissioners of Income Tax, after hearing representatives of the revenue department and of the Institution, gave a decision in favour of the Institution. After making provision for contingencies, there is a balance to the good on the revenue account of £3,616. Taking investments at cost and the Institution building and lease, the library and furniture, &c., at their values standing in the books after writing off depreciation, the assets amount to £194,097, against liabilities of £11,337, leaving a surplus of £182,760, which, in comparison with 1929, shows an improvement of £6,617.

Electrical Insulation and Synthetic Resins

IN a paper they read at the annual general meeting of the OIL & COLOUR CHEMISTS' ASSOCIATION, Messrs. W. D. OWEN and A. MORRIS THOMAS (of the Electrical Research Association) attempt to deal with a comparatively unexplored region which nevertheless is of great importance to the future development of the electrical industry. The first part concerns the chemical aspects of insulation, from which point of view materials may be classified under two headings, namely, "true" and "pseudo" dielectrics. The true ones, homogeneous substances, elements, or compounds, which do not form ions and do not possess free electrons. Only certain elements of low atomic number, such as hydrogen, carbon, oxygen, and sulphur are able to form true dielectrics, and it will be noted that they are the elements of which in general all organic substances, including synthetic resin, are formed. Pseudo-dielectrics are non-metallic substances which, although capable of ionisation, do not conduct electricity under ordinary conditions owing to the high internal resistance offered to the motion of their ions. Practically all industrial solid and liquid insulation is of this class; commercial insulating materials of an organic nature, though composed in the main of true dielectric elements, contain ionic impurities. A colloidal structure is inimical to ionisation and thus insulating materials are frequently found to be colloids.

The formation of synthetic resins by condensation and polymerisation is apparently just such a process as is required to produce good insulating materials, since the basic substances are true dielectrics which may be obtained in a high state of purity and no admixture with substances of an ionic nature need occur, except in so far as a catalyst is necessary. With improved methods of obtaining greater purity and avoidance, or neutralisation, of any ionic catalyst, considerable improvement in synthetic resin insulating materials should result. Any future expansion of the demand for phenol is likely to be satisfied by the manufacturers of synthetic phenol; supplies of natural phenol obtained from coal tar are not expected to be affected by the development of low-temperature carbonisation. Prediction of the properties of synthetic resins from the known chemical constitution of the primary substances would be of great value and certain suggestions of Mr. R. H. Kienle to this effect are mentioned. It appears that in a number of cases the physical properties of the final product depend on the number and position of the primary valencies possessed by the molecules of the initial products.

Regarding the electrical properties of insulation, volume and surface resistivity are greatly influenced by atmospheric conditions, and therefore careful conditioning is necessary before tests are made. Permittivity (the term now used generally instead of the older specific inductive capacity) is important when, as is often the case, different dielectrics are placed in series in an electric field. The breakdown of insulation may be caused by different processes, but industrial breakdowns are generally of a thermal nature due to the increase of power factor and dielectric loss with temperature. Frequently also breakdown is caused by discharges in the ambient medium (air) due to high stresses at the corners of conductors and insulation.

The Electrical Research Association has published a large number of reports dealing with methods of testing and insulation problems.

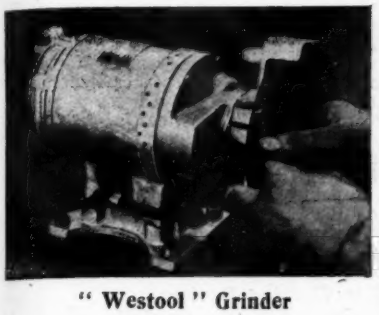
Mr. Wilkinson, chairman, in opening the discussion, referred to the difficulty of impregnating coils owing to lack of penetration of the varnish, and suggested that synthetic resin varnishes of greater penetrating power were needed. Mr. Bell doubted the correctness of the authors' classification of "true" and "pseudo" dielectrics, since he considered that a true dielectric was one which did not contain mobile ions. Elements of high atomic number existed in certain materials which could be classed as "true" dielectrics. Mr. Bryson referred to the effect of impurities and wondered whether it could be stated that neutralised impurities ceased to be impurities. Mr. Whitehead stressed the need for improvement in synthetic resin insulating materials. The great ignorance prevailing amongst manufacturers as to the physical properties of their products was commented on by Mr. Silver, who also suggested possible improvements.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Portable Grinder

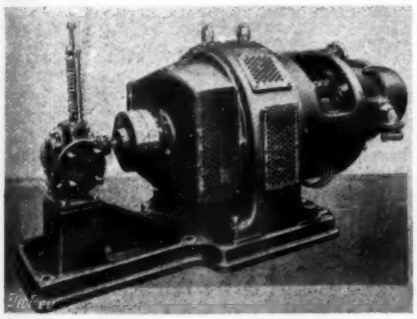
The WESTMINSTER TOOL & ELECTRIC CO., LTD., Westool Works, Putney, S.W.15, has just introduced a portable electric grinder for use on either a.c. or d.c. It consists of a fool-proof, thoroughly reliable, fan-ventilated, ball-bearing universal motor capable of driving a 6-in. diameter by ¼-in. face wheel under all normal working conditions. Fitted to an ordinary lathe the tool enables a wide range of grinding work to be carried out. It can be used with a 6-in. diameter wheel for external grinding or a 2-in. diameter wheel running at three times the speed for internal work. As a portable tool or fitted up for bench work it is equally useful and efficient. Whether used on d.c. or a.c., it is claimed that the speed cannot exceed absolutely safe limits both for the motor and the wheels. Although the tool is normally supplied as a complete unit with accessories for all the above uses, the makers are prepared to supply it as a single-purpose tool for any one of the applications.



"Westool" Grinder

H.P. Gear Pump

The "Roloid" high-pressure gear pump has been designed by DAVID BROWN & SONS (HUDDERSFIELD), LTD., Park Works, Lockwood, Huddersfield, to overcome difficulties and objections inherent in gear pumps of its type. It is a very simple form of positive-acting fluid-pumping equipment. Two rotors, carried on roller bearings, are the only moving parts. For combined high-speed, high-pressure work the pumps are so small that they may be flange-mounted on the casing of the driving motor, thus eliminating a bedplate, coupling, &c. The flange-mounted, directly-coupled type has a successful application in the "Roloid" car-washing equipment distributed by Mann, Egerton & Co., Ltd., Prince of Wales Road, Norwich. The discharge from the pump is continuous, the slight fluctuation in the discharge rate as each pair of teeth come into action being not sufficient to call for the use of an air vessel to steady the flow. The rotors are made of case-hardened, surface-hardened or stainless steel, or "nitralloy," and the bodies are of bronze, cast-steel or cast-iron, according to the speed and pressure of operation, and to the nature of the fluid to be dealt with. The pump will deal with water at 400 lb. per sq. in. and lubricating oil at 200 lb. per sq. in., and once the rotors are wetted by the fluid to be dealt with the pump needs no priming and will give a suction, when empty, sufficient to lift several feet. The apparatus is made in sizes up to 5 h.p. with speeds up to 2,000 r.p.m.



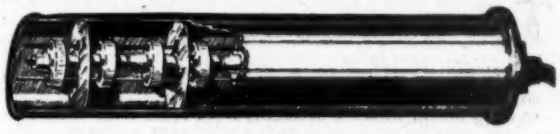
"Roloid" Fuel-oil Pump

Armoured Overhead Cable

A cable recently supplied by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1, to the Toronto (Canada) hydro-electric undertaking, offers a solution to the problems of the distribution engineer with regard to overhead lines where local amenities have to be preserved and tree-cutting amounts almost to sacrilege. The cable comprises a length of 0.0225-sq. in. single-core 2,400-V equipment for self-supporting suspension on concrete poles. The conductor is of high-conductivity copper, varnished cambric insulated, jute braided, armoured with a single layer of 23/.072-in. special aluminium-alloy wires, jute braided and compounded overall. This design provides an insulated cable suitable for overhead use and light enough to allow of the use of concrete poles which cannot be used to take the dead-end strain of the usual messenger construction, *i.e.*, l.c. cables suspended from a catenary or messenger wire. The aluminium-alloy armouring gives the desired longitudinal strength, and at the same time gives a metallic protection which, unlike steel, results in no hysteresis loss when used in connection with a single-phase a.c. supply. The special armouring is covered by patents in Great Britain, South Africa, and Canada. Patents in Australia and India are pending.

A Tubular Heater

Complete elimination of condensation troubles and immunity from breakage in transport or erection are the outstanding claims made by ELECTRIC LAMP FACTORS, LTD., 41, Rathbone Place, London, W.1, for the "J.P." electric tubular heater which they have just introduced. It consists of a spiral element encased in a 2-in. steel tube of either flexible or rigid construction. The element, which operates at black heat, is supported by a patented insulated structure composed of a rustless-steel spring on which is threaded insulators and mica disks, the latter being spaced at adequate intervals; it is supported by the disks throughout the full length of the heater. Suitable

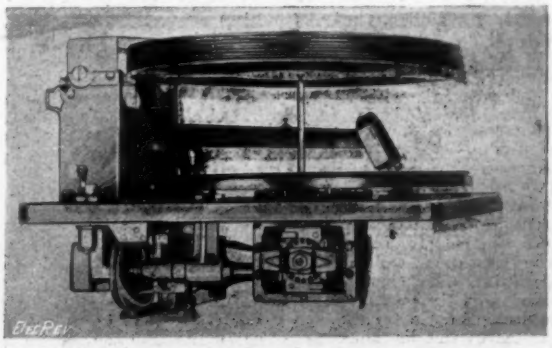


Construction of Rigid "J.P." Heater

end-caps are provided for the wiring connections, and they are supplied tapped to take all sizes of tubing up to and including ¾-in. electric conduit, or for insulating bushes. Earth connections can be made to the terminal provided on the screwed rod inside the end-cap, or an external connection can be made to an end-cap fixing screw. Both types of the heater, rigid or flexible tube, are suitable for either floor, skirting-board or roof mounting. The rigid pattern is supplied in lengths up to 17 ft. and in dark-oak standard finish, while up to 20-ft. lengths of the flexible type are obtainable in aluminium finish. The standard loading for both types is 60 W per ft. for all common voltages.

An Automatic Record Changer

The SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2, is marketing the "Capehart" record changer, a compact and robust instrument which can be used with any good radio receiver, turning it into an automatic radio-gramophone. The machine embodies a 32-W, a.c. motor, record-changing gear, gramophone pick-up and tone arm, main switch, rejector button and volume control. The motor, in addition to driving the turntable, also operates the record-changing mechanism. Briefly the method of operation is as follows. When the motor is started a master cam lifts up the tone arm, swings it across over the turntable and slowly drops the pick-up on to the commencement of the record tracking. A dog clutch is then released, which cuts off the motor from the master cam and leaves the drive on the turntable only. As soon as the pick-up has reached the end of the record a catch is released which again brings the master cam into operation. The pick-up and tone arm is then lifted off the record and swung clear of the outer diameter, and the loading mechanism feeds a further record down to the turntable from the magazine. This cycle of operations is repeated until the magazine is empty, when the last record is repeated until the machine is switched off. The magazine holds either 12- or 10-in. records, the full complement being 10 disks. It is not, however, possible to use both 10- and 12-in. records at the same time. By simply setting two levers the magazine is ready to receive either size. Provision is made for rejecting any record when it has commenced playing, and it is important to note that during the operation of record changing the pick-up is short-circuited, so that no sound comes through the loud-speaker. For a time every trader who orders a "Capehart" will be supplied free with a special cradle on which the equipment can be mounted for window display. Underneath this cradle is an inclined mirror and strip light, so that the whole operation can clearly be seen whilst the machine is working.



"Capehart" Gramophone Record Changer

Safety in Industry

National Congress at Leeds

THE National Safety First Congress was held at Leeds last week, when a number of matters relating to the prevention of accidents in factories, mines, streets, &c., were discussed.

One of the most interesting papers before the Congress was that read by Mr. J. Turner, the Safety Officer of the British Thomson-Houston Co., Ltd., entitled "The Safety Officer and Safety Committee." After a brief introduction by Mr. L. E. Mather, of Mather & Platt, Ltd., who is the chairman of the Manchester Industrial Safety Committee, the speaker dealt with the work which was being done at the Rugby works of the B.T.-H. Co. He said that the B.T.-H. Co. had taken an active part in definite accident prevention work since 1913.

He referred to the increases in recent years in steam pressures and in the cutting speeds on machine tools brought about by the introduction of tungsten-carbide alloys. He described how in many cases accidents had been reduced very considerably, resulting not only in relief from physical injury but also from injury to health, and checking the dangerous reduction of morale. The Safety Officer, he said, must combine tact and sympathy with initiative, courage and patience, and must secure the co-operation of superintendents and foremen. He must keep a vigilant eye upon manual operations and small tools to ascertain whether accidents from those fruitful sources of injury were being reduced to the minimum, as for example, the elimination of such frequent causes of accidents as worn spanners, burred chisels, files with defective handles, &c. If safety work was viewed merely from a production standpoint, it might be asserted that accident prevention tended to increase the quantity and quality of the goods.

The manager to whom he was responsible, Mr. A. P. Young, extended all possible assistance to the Safety Officer and the Safety Committee; this was a great asset in any plant, because if the head was confident of the value of safety work, the same spirit would permeate the whole organisation.

Safety Committee Personnel

For a large electrical engineering works it was suggested that the Safety Committee should include a representative from the manager's department, the plant engineer, engineers in charge of test areas, foremen of electrical and mechanical installation and maintenance departments, superintendents and assistant foremen of manufacturing departments, and workpeople's representatives.

In the British Thomson-Houston works at Rugby were twenty-four representatives of the workers, from which a suitable number were selected by rota. The functions of the Safety Committee were then described, and the speaker went on to deal with protective apparatus, saying that the company had recently designed a guard on entirely new lines for the cutters of milling machines. This could remain permanently on the machine, gave efficient protection, and saved a considerable amount of time in changing from one job to another. They were trying, he said, to put goggles on the emery wheels and triplex glass guards on the band saws, and the workers had expressed much satisfaction. His concluding remarks dealt with the proneness of new employés to accident and the necessity for educational campaigns.

Safety Clothing Devices

Mr. R. W. Gorman Davies, M.A. (director of Siebe, Gorman and Co.) gave an interesting address on "Safety Clothing Devices." Attention was drawn by the speaker to the fact that during the last quarter of a century workers had been exposed to increased potential dangers. On the other hand, a larger number of safety appliances were now on the market. Dealing with external safety appliances, Mr. Davies displayed samples of rubber shoes and gloves for electrical workmen and also goggles and electrical welders' helmets.

Towards the end of his address Mr. Davies mentioned the increasing use of oxygen and oxygen plus carbon-dioxide for the treatment of persons overcome by electric shock, drowning and gas poisoning. First-aid tenders with well-trained crews were now being provided by the larger electrical companies in this country.

Many questions were asked, the most important yet simple one being whether or not ultra-violet rays were too strong for a blue glass in goggles. The quality of the glass and the length of the ray were the two points which decided this query.

Technical Education in Russia

Training Electrical Engineers and Mechanics

INSTRUCTION in electro-technical subjects in Russia started early in the "eighties" of the past century at the Technological Institute in Petrograd, this being followed in 1886 by the establishment of a technical school (now the Electro-technical Institute) by the Post and Telegraph Authorities. Prof. P. S. Ossadschy, writing recently in *Electritchestvo*, states that attention was at first confined to two subjects—telegraphy and electrical measurements—but that later the scope of the instruction was extended and between 1886 and 1900 instruction in electrotechnics was added to the curriculum of the Petrograd Technical High School; a new electrotechnical school and a polytechnic institute with an electrotechnical faculty were also opened in the same city. All instruction consisted of lectures, there being up to that time no electrical laboratories. Considerable progress was, however, made during the first twenty years of the present century. New professorships were created and a number of well-equipped laboratories established; despite an insufficiency of opportunities for workshop practice a number of electrical engineering students received such a good scientific education that they were able to take over the management of various technical undertakings.

Following the revolution in Russia, Prof. Ossadschy in 1918 drew up proposals for the introduction of a series of restricted but more specialised courses in electro-technical subjects reducing their length to 3½ years, *i.e.*, seven terms, of which the three summer terms were to be devoted to practical work and the final term to preparation for a diploma in the subjects taken. The scheme did not, however, find support at the time; instead, new electrotechnical faculties were established at the technical high schools of Moscow, Kharkov, and Kiev, more attention than formerly being given to work of a practical character. In 1922, Professors Chatelain and Ossadschy submitted proposals with respect to new methods in workshop practice for students in electrotechnical schools, Prof. Ossadschy favouring a scheme under which, as part of their training, students were set to work as ordinary mechanics in the shops, and towards the end of their course as assistants to the workshop foremen. Although the idea was not fully adopted, an interesting experiment was made in Moscow of combining technical instruction with workshop practice by the Electrical Engineering Institute under the direction of Prof. J. F. Kagan, under which the students spent two days (of 10 hours) per week at the Institute and four days in electrical engineering workshops, and the experience gained during the past ten years of this method has provided valuable information as to future methods of electrical engineering instruction throughout Russia.

At the present time courses in electrical engineering are regularly held at seven technical high schools throughout the country, *viz.*, at the Lenin Electrotechnical Institute and the Kalinin Polytechnic Institute in Petrograd, the Electrotechnical Faculty of the Technical High School, the Electrical Industry Faculty of the Institute of Social Economy, the Institute for Electrical Engineering, in Moscow, the Electrotechnical Faculty of the Technological Institute, Kharkov, and the Electrotechnical Faculty of the Polytechnic Institute in Kiev. The course at the first five of the foregoing establishments extends over five years and in the remaining two over 4½ years. In the technical high schools the course comprises lectures, exercises, designing, and laboratory work. During the summer and winter holidays students are sent into different workshops and must sit for a final diploma examination. The number of students attending the various schools reached, in 1929, a total of 10,000, although only from 600 to 700 per year have so far qualified as electrical engineers.

In addition to the foregoing there are about 15 technical schools for the education of electrical mechanics, in which the curriculum is individualised to meet the particular requirements of the districts in which they are located. Special schools are also maintained for the training of telegraph and long-distance telephone operators. Under the Soviet Government, the tendency of technical training has been to limit the time spent in the schools to the minimum and to secure a maximum of combined theoretical and practical instruction. When the students are engaged in actual workshop practice they are under the personal supervision of the works engineer, on lines laid down by the teaching authorities. Since 1929, a new scheme of technical instruction has been adopted under which the previous five-year course is reduced to four years (twelve sessions). Subject specialisation begins from the first lecture; 40 per cent. of the student-hours must be devoted to workshop practice, and students must, in addition to six hours at school, do four hours home work. The new scheme necessitated a fresh curriculum being drawn up by the teaching staff. The theory of electrical and magnetic phenomena has been concentrated in a course known as the theoretical groundwork of electrotechnics, from which the physics course has been entirely separated and which forms the basis for all the specialised courses. A new series of technical instruction books based on the new course has also been drawn up.

Coincident with the reorganisation of the older electrotechnical schools, new ones are to be established in the vicinity of all large electrical engineering works in order to keep up a steady supply of well-trained electrical engineers and mechanics.

Keeping Electrical Contract Accounts

By S. HOWARD WITHEY, E.C.I., &c.

THE electrical engineer who undertakes to perform any kind of work, or to render any services, at a stipulated figure, will naturally wish to ascertain the amount of profit realised, or the extent of the loss sustained, and in order to be in a position to arrive at reliable figures upon which to base estimates and quotations, it is always advisable to keep separate job or contract accounts, quite apart from the personal accounts opened in the names of the persons, firms or companies with whom the contracts or agreements have been made.

The fact that a contract has been entered into does not, however, necessitate any entry being made in the books of account, although as soon as any machinery, plant, or apparatus is employed, or any goods, articles, materials, or stores purchased or taken from stock for the purpose of proceeding with the work an account should be opened, showing the number of the job or contract and a description of the particular work to be performed. Each contract account will have to be debited with the invoiced cost of all goods, gear, tools, and stores which have been purchased or used, including the cost of carriage and cartage on any special equipment which it may be necessary to employ, the wages paid to electricians and other workers exclusively engaged on the job, an adequate sum for the use of motors, machines, lathes, drills, and any other assets, and all other charges which have the effect of increasing the actual cost of fulfilling the obligations entered into.

In those instances where tools have been used for removing ridges, bars, spots, &c., some effort should be made to determine the difference between the book value and the realisable value of such tools in order that the contract account may be charged with the full and proper amount under that heading. If any apparatus or equipment used in the execution of special work is disposed of at a lower price than the amount actually charged against the contract, the difference should be recorded on the debit side of the account under the heading of depreciation or wear and tear.

The Ascertainment of Profit

On the credit side of each contract account will appear the sums of money received by the engineer during the period covered by the agreement, these amounts having been posted direct from the debit side of the general cash book, or from the cash-received book, as the case may be. As soon as a contract has been completed, the balance of the contract price should be recorded as a separate item on the credit side of the particular contract account, whence the amount should at once be transferred to the debit side of the respective personal account. The difference between the debit and credit totals of the contract account will then represent the amount of profit realised, or the extent of the loss sustained. At balancing time, this balance will have to be transferred to the periodical profit and loss account, whereas the balance which is shown in the account of a contract which is still in progress at the date of stocktaking should be treated as a balance sheet item.

An alternative method of contract bookkeeping consists of recording on the credit side of the personal account all items of cash received before the completion of the work, and debiting the contract account with the cost of the goods, equipment, materials, and stores used in connection with the job; the wages paid to electricians and workers engaged on the job; and the overhead charges. Upon completion of the contract, the balance of the contract account should be transferred to the debit side of the personal account.

Wages paid to clerks exclusively engaged on a contract should be charged against the particular contract account, but wages which do not increase the cost of fulfilling the job, or of rendering services directly connected therewith, should not be charged under the heading of labour.

Joint Contracts

In those instances where two or more engineers, firms, or companies jointly undertake to purchase certain electrical goods or equipment to be used in the execution of any contract, or for sale at a profit to be shared between them on an agreed basis, it is advisable to keep separate joint accounts in order to ascertain the precise amount of profit to be transferred to the periodical profit-and-loss account. Each joint account should be debited with the invoiced cost of the goods or equipment purchased, this amount being posted to the credit side of the supplier's personal account kept in the purchases or bought ledger, and if any goods or articles, materials or stores are obtained from the engineer's own stock, the price of these should be recorded in the day book and debited direct to the particular joint account. All management and working expenses incurred in connection with such transactions would have to be posted from the cash book to the debit of the joint account, and expenses accrued but unpaid at the balancing or stocktaking date should be recorded on the credit side of the respective personal accounts and debited to the joint account. Upon the disposal of any goods or equipment included in a joint venture, the joint account should be credited with the prices charged against the contracts or against customers, while any amounts of cash received from a joint partner on account of his share of the cost should be credited to the partner's personal account direct from the cash book.

Any commission due to the engineer would be debited to the joint account and shown on the credit side of the commission account, and directly all the goods and equipment have been sold or disposed of, each partner should be credited with his share of the profit, the balance of the joint account being then transferred to profit-and-loss.

Engraving Works Lighting

THE accompanying illustration shows a recent lighting installation, employing fittings supplied by the BENJAMIN ELECTRIC, LTD., in the shops of the Sun Engraving Co., Ltd., of Watford. As may be seen, the installation is extensive; it consists of 250 Benjamin "Glassteel" diffusing units mounted 12 ft. above the floor and spaced at a distance of 12 ft. by 11 ft. The resulting intensity of illumination at working level is eight foot-candles, the light being evenly and uniformly distributed with an entire absence of harshness.

When the installation was planned, a test was carried out in a section of the shop measuring 55 ft. by 37 ft. 6in. Under the previous system the total load was 3,050 W and a somewhat uneven intensity, ranging from four to ten foot-candles, was obtained by the use of eighteen reflectors.

When the "Glassteel" units were installed in the place of the existing reflectors, the resultant intensity became entirely uniform, and was found to be eight foot-candles; fifteen 200-W units were used, and the total load was thus reduced to 3,000 W.

The units consist of a heavy-gauge steel reflector, with a porcelain enamel finish inside and out, and a glass diffusing bowl which can be easily detached for cleaning or the renewal of the lamp. Round the top of the reflector are a series of small apertures which permit a small portion of light to be projected upward to reduce the contrast between the illumination of the areas below and above the fitting.

In addition to this installation, the Sun Engraving Co. utilises 60 Benjamin "Horolux" units in its stores, where the same high standard of efficiency is maintained.

We are informed that this installation is the outcome of many severe competitive tests carried out by the management of the Sun Engraving Co.

A "Benjamin" Lighting Scheme

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The Whitsun Holidays

Owing to the holiday, the offices of the ELECTRICAL REVIEW will be closed from to-night, Friday, until Tuesday morning next.

The London Chamber of Commerce

Included in the report for 1930 of the London Chamber of Commerce, which was presented at the annual meeting on Wednesday last, are brief reports of the activities during the year of the Electrical and Allied Trades Section and the Household Appliances Section. The former re-elected Messrs. P. M. Rossdale and A. M. Sillar as chairman and deputy-chairman, respectively, and presented the views of members on a number of subjects of general application with which the Chamber is dealing. The report of the Household Appliances Section deals particularly with the subject of hire-purchase selling. It records the formation of the Hire-Purchase Clearing House, Ltd., regarding which the Section considers that "it would be unwise to commit itself to the scheme at this early stage."

Forthcoming Exhibitions

Among the exhibitions which are being held in the autumn are the biennial International Exhibition of Shipbuilding and Engineering, from September 10th to 26th, and the National Radio Exhibition, from September 18th to 26th.

The British Industries Fair

Following upon the recent report by the Chelmsford Committee of the British Industries Fair, the Government has set up a committee "to consider and report how permanent accommodation for the London Section of the British Industries Fair can be provided and financed on a self-supporting basis, and to formulate definite proposals." Sir Gilbert Garnsey, K.B.E., is the chairman of the committee, while five of the members served on the Chelmsford Committee, including Mr. G. H. Locock, C.M.G., Assistant Director of the F.B.I., and Sir Gilbert Vyle (W. & T. Avery, Ltd.). The secretary of the committee is Mr. G. H. Meadmore, Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Sterling Domestic Apparatus

The domestic apparatus side of the business of the Sterling Telephone and Electric Co., Ltd., has been purchased by the General Electric Co., Ltd., which will continue to carry stocks of the specialities of that company. As from June 1st orders should be addressed to the General Electric Co., Ltd., Bell and Telephone Department, Magnet House, Kingsway, W.C.2, or to the company's branch offices.

E.D.A. in the North-West

The second annual report of the North-West Area Committee of E.D.A. contains notes upon various activities pursued in this important territory during 1930. The membership was increased; four additional supply undertakings joined up, while three others increased their subscriptions. A panel consisting of representatives of supply undertakings and manufacturers investigated the possibilities of electric heating for process work in the cotton textile industries, and a large amount of data was collected. During the year four area conferences (average attendance 59) were held and 54 lectures were delivered to many kinds of audience. There are four circles in active existence in the area; these are the Manchester, Salford and District, the Liverpool and Merseyside, the Fylde Coast District, and the North Wales District Circles. Endeavours are being made to form Circles in other parts of the area. Special attention has been paid to the subject of rural electrification, and the Area Committee played its part in the Outlet and Shop Lighting Campaigns.

Electrical Fire Brigades

This year's annual competition of private fire brigades for the Corporation of London's Challenge Shield resulted in an outstanding triumph for the three brigades entered from the factories of Standard Telephones and Cables, Ltd. The brigade from that company's Woolwich factory tied for first place with the Midland Bank's Brigade, whilst the brigades from the New Southgate and Hendon factories finished third and fourth, respectively. The fire brigades of the Osram Lamp Works and the Fraser & Chalmers Works of the General Electric Co., Ltd., were also in the competition.

The Egyptian Mission's Report

The conclusions and recommendations of the recent United Kingdom Trade Mission to Egypt follow very closely those of previous missions to other markets, due allowance being made for the local conditions. The high prices of British goods are again put forward as the main handicap to British trade with the country; the need for a thorough study of the market by principals is stressed; more propaganda is shown to be essential; credit facilities are touched upon; and the grouping of firms for representation in the market are suggested. The report deals primarily with the textile trade and little is said regarding the prospects for the sale of British electrical plant in Egypt. It is mentioned that Belgian financiers have recently organised two large companies—one to construct railways, tramways, ports, power stations, &c., and the other to produce and sell electricity.

Speeding-up Electrical Development

It will be remembered that earlier this year the Minister of Transport (Mr. Herbert Morrison) convened and addressed conferences of representatives of electricity supply undertakings in Glasgow, Manchester, London, Leeds and Bristol. His object was to urge the acceleration of development, for instance, by the laying of mains well in advance of the demand, and by instituting hire and hire-purchase schemes for wiring and appliances.

Mr. Morrison's statement at these conferences has now been published through the Stationery Office, and may be obtained from the Secretary to the Electricity Commission.

Employment during April

The May *Ministry of Labour Gazette* states that although employment in the engineering industry as a whole remained bad during March and showed little change, there was an improvement in the electrical section. The number of unemployed in the engineering industry at April 27th was 247,739, a decrease of 209, which was insufficient to lower the percentage, 24.4. The number of unemployed in the electrical engineering section declined to 13,402, the proportion thus being reduced from 15.2 to 14.9 per cent. There were increases in unemployment in the electric cable, wire and lamp manufacturing group and in the electrical wiring and contracting industry. In the former the number rose to 16,325 and the proportion from 15.3 to 15.9 per cent.; in the latter the number increased to 3,042, and the percentage from 15.7 to 16.4.

New Municipal Showrooms

The electrical engineer to the Sale U.D.C. (Mr. C. J. Wood) informs us that his Council is opening showrooms in the main shopping street for the display and demonstration of electrical apparatus. He asks manufacturers of appliances, fittings and novelties to send particulars of their products to the Electricity Department, Town Hall, Sale.

Wages in the Engineering Industry

At a meeting of engineering workers in Birmingham on May 17th, Mr. W. H. Hutchinson, president of the Amalgamated Engineering Union, reported upon the result of the last conference between the engineering trade unions and the employers. He expressed the opinion that there would not be a lock-out, as he did not think that the employers were in any stronger position in this respect than the unions were in the matter of striking.

Bexley and Foreign Cables

At its last week's meeting, the Bexley U.D.C. considered tenders for cables. It was reported that the lowest offer (£6,171) was from a German firm, while the lowest British tender, that of Messrs. Johnson & Phillips, Ltd., whose works are in that part of Kent, was £8,434. Upon being approached, Messrs. Johnson & Phillips had agreed to reduce their price by 2½ per cent. The Council was equally divided between acceptance of the British and German tenders. The chairman declined to give a casting vote, and the Ministry of Health is being asked to make a decision.

The West Indian Refrigerator Market

The British Trade Commissioner at Port of Spain, Trinidad, has furnished the Department of Overseas Trade with a report on the market for small automatic electric refrigerators in the British West Indies. He says that, so far as can be ascertained, none of the small household refrigerators found in the West Indies are of British manufacture. There is an increasing demand for these refrigerators in Bermuda and the Bahamas, but elsewhere in the Colonies the demand is very small. It is thought that a machine selling at a lower price than American models might secure a small sale, but it is essential that it should also meet the peculiar conditions of the market.

For Sale

The electrical engineering business of Telford, Grier and Mackay, Ltd., now in voluntary liquidation, is offered for sale as a going concern.

Liverpool Tramways Department invites tenders for the purchase of disused plant.

(See our advertisement pages to-day.)

Greek Electrical Imports

According to an official return just to hand, 1,158 tons of electrical apparatus valued at £201,230 were imported into Greece last year, as compared with 1,167 tons valued at £149,605 in 1929. The Greek imports of wires and cables during the same period declined from 11,306 tons (£279,355) to 9,491 tons (£220,260).

New Italian Companies

Among the concerns recently organised in Italy are the Società Idrotermica Produzione Elettrica e Distribuzione (S.I.P.E.D.), of Milan; La Società Apparecchi a Relais, Milan; La Società Agenzia Italiana Lampade Pope, Milan, to market Pope electric lamps in Italy; La Società Conzorzio Elettrica Padano per Distribuzione Energia Elettrica, Milan; and La Società Azienda Elettrica di Val Brembilla, Brembilla.

Ferranti's Extension

It is very satisfactory in these days of slackness in industry to find electrical manufacturing companies extending their works. We have mentioned several cases of the kind during the past year, one of them being Messrs. Ferranti, Ltd.,

Ferranti's Works Extension

who have now sent us a photograph (reproduced above) of their new building in course of erection. The company's main works and railway siding at Hollinwood, Lancs., can be seen in the background.

Retford and Local Contractors

The Retford Town Council has rescinded a minute made in 1928 to the effect that electrical work for the Corporation should be carried out only by members of the Electrical Contractors' Association. The Mayor said that when the minute was passed there were five firms who were members of the Association, but at present there were only two members. As a result of canvassing, applications for the supply of electricity were so numerous that it was impossible to get through the work; there were 112 applications on hand. There were several qualified traders who were capable of doing the work, but were not members of the Association.

London J.E.A. Propaganda

The London & Home Counties Joint Electricity Authority is now actively operating, and under the leadership of Mr. F. W. Purse, the chief engineer, is making great efforts to popularise electricity in districts where high prices have hitherto proved a considerable handicap. We have received copies of about a dozen posters which are being exhibited throughout the areas in which the J.E.A. controls the supply. Some of these bear a simple message stressing the advantages of several applications of electricity. Others are of an artistic nature and by pictorial means impress upon the reader the readiness, cleanliness, and general desirability of electrical service. In addition to these, booklets have been produced dealing with the subject of electricity in the home—what electricity will do, what it costs, what it saves, how it can be obtained, and many other matters are attractively treated. New tariffs have been introduced, and hire and hire-purchase schemes have been instituted. Consumers or "prospects" are urged to apply for further information at the district offices of the Authority in Dorking, Leatherhead, Surbiton, and Twickenham.

New Australian Companies

Among the recent registrations of companies in Melbourne are the following: Concord Electrical Co. Pty., Ltd., capital £25,000; and Allan S. Duke Pty., Ltd., capital £20,000, manufacturers of radio and electrical goods.

Electricity at the Berlin Building Fair

A feature of the Building Exhibition, which has just been opened in Berlin, is the attention which is being devoted to the question of increasing the use of electricity for domestic purposes. In one of the sections a number of "houses of the future" are displayed which are not only electrically lighted but are equipped with electric fires, cooking ranges, water heaters, &c. During the course of the Exhibition special lectures are to be given with the object of enlightening the public as to the advantages of electrical appliances; the attention of architects and builders is also being drawn to the necessity for providing a liberal supply of power points when designing and building houses, it being pointed out that this adds very little to the cost when done during erection.

Social Events

A number of competitions have been arranged at Preston by the Siemens Lamp Works Sports Club for the 1931 season and the first of these, "The Dr. Wright Prize," was competed for by the Golf Section on Saturday, May 9th. An 18 holes medal competition was played over the Dick Kerr Club Course at Ashton Park and was well supported. The leading cards were: K. L. Lochhead 94-24-70, P. D. Oakley 93-22-71, W. T. Le Marechal (junr.) 92-18-74, E. Allen 90-16-74, W. G. Creasy 90-15-75, and J. N. Aldington 83-6-77.

Seventy persons were present at a dinner held at the "George" in the Strand on May 8th to celebrate the success of the G.E.C. footballers in winning four trophies during the season just closed. Mr. Leslie Gamage was in the chair, supported by Mr. M. J. Railing, joint managing director of the company. An excellent entertainment, arranged by Mr. Knight, the hon. secretary, concluded a very enjoyable evening.

Trade Announcements

Messrs. HANS RENOLD, LTD., and the COVENTRY CHAIN CO., LTD., announce that their various branches throughout the country have now been reorganised or established in the following centres:—London: Bush House, Aldwych, W.C.2; Birmingham: 61-65, New Street; Manchester: 308, Deansgate; Leeds: 13-14, Park Place; Bristol: 19, Rupert Street; Leicester: Phœnix Buildings, Berridge Street; and Coventry: 11, Warwick Row.

New premises have recently been opened by the CARWIN ELECTRIC CO. at 45 and 47, Corporation Street, Preston.

Messrs. GRADLEY, LTD., have moved to larger premises at 1, Castle Street, City Road, London, E.C.2. Their telephone numbers are: Clerkenwell 7218 and 7219, and the telegraphic address "Slickserve, Finsquare, London."

Messrs. W. H. AXWORTHY & CO., electrical and radio engineers, of 106, Tavistock Road, Plymouth, have opened a branch establishment, devoted mainly to radio, in Athenæum Arcade, Plymouth.

We are informed that the connection between Messrs. MARRYAT & SCOTT, LTD., and JOHN BENNIE, LTD., has been severed, and that the resignations of Mr. Murray D. Scott and Mr. Howard Marryat from the board of the latter company have been accepted.

Patent Restoration

An order has been made restoring letters patent No. 261,864, granted to Mr. R. N. Winter and Mr. H. C. Daly for an invention entitled "Improvements in or relating to grid leaks and condensers for use in connection with radio apparatus."

Transporting a Large Transformer

At the recent annual meeting of the British Electric Transformer Co., Ltd., the chairman (Mr. A. F. Berry) mentioned the "grid" orders received by the company from the Central Electricity Board. Among the equipment which the company is supplying are two 45,000-kVA, 132/11-kV transformers for installation at the Bartley Green sub-station of the Central England Scheme. These are to be ready for service some time in July, and we reproduce a photograph of one of them on its way to the site. The weight of this transformer

A Large Berry Transformer for the Central England Scheme

necessitated the use of a special multi-wheeled carriage and two traction engines were employed.

International Export Trade

Mr. Leslie Gamage, secretary of the General Electric Co., Ltd., read a paper dealing with a number of export matters at last week's conference of the Chartered Institute of Secretaries. He pointed out that this country was dependent more than any other upon its export trade and it was essential that all our energies should be concentrated in this direction. Our principal handicap was high prices and we were losing a great deal of overseas trade for this reason. The existing standard of living in this country forced the price of our products above the general world level. Mr. Gamage said that the folly of unrestricted international competition was now being realised, and in many industries arrangements in the form of trusts, cartels, and restrictive agreements were being made by producers in all countries. The allocation of work was usually based on the amount of business done before the agreement; it was, therefore, essential that we should prepare for this by keeping up our trade.

Registered Electrical Contractors

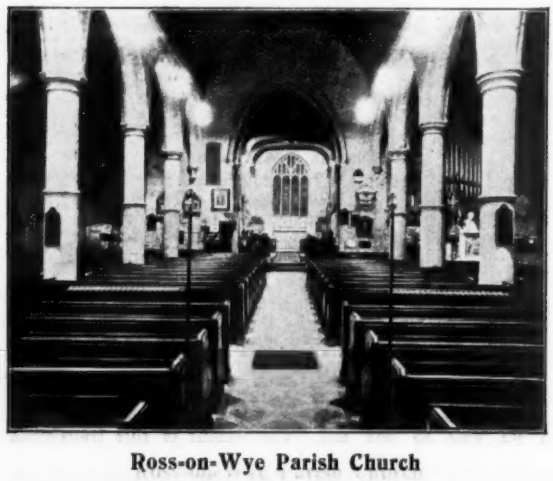
Applications from the following for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Bayton Electrical Co., Gorton, Manchester.
Building & Colliery Supply Co., Ltd., Doncaster.
Hinchliff, G., & Co., Penistone, near Sheffield.
Baldwin, W. M., & Co., Acocks Green, Birmingham.
Kelvin Electric Co., Hanley, Staffs.
Hurley, Edwards & Thomas, Ltd., Cardiff.
Bates, J. H., & Son, Burslem, Stoke-on-Trent.
Burton, F., Birmingham.
Chapman, F. L. G., Southsea, Hants.
Heaney, J., & Co., Birkenhead.
Bruce, C. D., Altrincham.
Davis, A., & Son, Portsmouth.
Fitzwater, W. J., Hounslow.
Gosling, C. W., Bromley.
Thorpe, F. B., Doncaster.
Knowles & Laing, Bath.
McClure & Whitfield, Stockport.
Davies, Ivor, Carmarthen.
Rolland, Alex., & Co., Dunfermline.
Ball, A. H., Birmingham.

At the same meeting eleven applications were declined.

Lighting of Ross-on-Wye Church

The parish church at Ross-on-Wye is an excellent example of Gothic art, and the EDISON SWAN ELECTRIC CO., LTD., to which the installation of electric lighting was entrusted, was faced with the problem of providing good modern lighting without impairing the architectural conception of the interior. The solution was found in the installation of Gothic lanterns



Ross-on-Wye Parish Church

in the nave and aisles, supplemented by Type1455 "Ediswan" projectors in the chancel and sanctuary. The result, as will be seen from the accompanying illustration, is very pleasing, and has evoked much eulogistic comment.

Recent Contracts

Referring to the placing of a contract with them for boiler draught plant by the Newcastle-upon-Tyne Electric Supply Co. (recorded here last week), MESSRS. DAVIDSON & CO., LTD., state that this is one of the largest orders of its kind which has ever been placed in the British Isles. The boiler plant for which this mechanical draught installation is intended comprises twelve large units arranged in three groups of four boilers, each group supplying steam to a 50,000-kW turbo-alternator set. The draught plant will comprise 48 electrically-driven "Sirocco" fans, 24 for forced draught and 24 for induced draught. All of them will be driven by direct-coupled totally-enclosed squirrel-cage motors, and provision will be made for the speeds of the fan shafts to be varied as required. For eliminating the dust and grit from the flue gases, 72 "Davidson" patent direct type flue-dust collectors are being supplied in groups of six collectors per boiler unit. The flue gases will be passed through the collectors before being handled by the induced draught fans, thus extracting all abrasive matter from the gases before it reaches the fans. The contract also covers the provision of a regulator equipment arranged to control the draught in the boiler furnaces automatically by varying the speeds of the induced-draught fans through the above-mentioned hydraulic couplings.

STANDARD TELEPHONES & CABLES, LTD., has received an order for supervisory remote control gear for the York sub-station of the Mid-East England Scheme.

The GENERAL ELECTRIC CO., LTD., has received an order from the Sunderland Corporation Tramways and Motor Department for 24 self-ventilated tramway motors type "WT.28K.S.," each rated at 50 h.p., 500 V, on the one-hour rating.

Messrs. FALCONAR, CROSS & CO., LTD., Newcastle-on-Tyne, have received the contract for the electrical work in connection with the complete reconstruction of the Queen's Hall Cinema, Hexham, for the Hexham Entertainments Co., Ltd.

Messrs. Milliken Bros., Ltd., radio and transmission tower engineers, have placed orders, valued at over £100,000, with the PEARSON & KNOWLES ENGINEERING CO., LTD., for the fabrication and galvanising of 6,000 tons of transmission-line towers for the South-West England and South Wales Electricity Scheme, and for the fabrication and erection of towers for the River Thames crossing.

Book Notices

"Elementary Hyperbolics for Technical and Other Students—Vols. I and II," by M. E. J. Gheury de Bray. Vol. I, pp. x+351; figs. 86. Vol. II, pp. xii+209; figs. 35. London: Crosby Lockwood & Son. Price 7s. 6d. per volume.

"Applied Mathematics for Engineers, Vol. III—Differential Equations with Applications," by T. Hodgson, B.A., B.Sc. Pp. viii+320; figs. 126. London: Chapman & Hall. Price 13s. 6d. net.

Punch Summer Number, 1931. Price 1s.—As usual, this issue contains art and humour skilfully combined, with many sly digs at prevailing crazes.

"Compressed Air Terms and Definitions." Pp. 16. British Compressed Air Society, 74, Victoria Street, London, S.W.1. Price 1s. net.

New Catalogues and Lists

The DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, Middlesex.—A leaflet, giving details of "Drayton" gas regulators.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2.—A showcard, produced in striking colours, issued for the display of "Philips" aerial dischargers.

The IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, London, E.C.4.—An illustrated folder (No. 6715), relating to "Igranic" radio components.

HEYES & CO., LTD., Water-Heyes Electrical Works, Wigan.—The May issue of the "Wigan Review," containing particulars of the "Wigan" prismatic bulkhead fitting. Also a folder (L.F.1) announcing reduced prices of "Wigan" lighting fittings.

STEATITE & PORCELAIN PRODUCTS, LTD., Stourport.—A folder, showing examples of bushing insulators for transformers and switchgear.

A. C. COSSOR, LTD., Cossor Works, Highbury Grove, London, N.5.—A leaflet, giving details of the "Cossor" gramophone pick-up and tone-arm, with illustrations showing how to connect it to the various types of "Melody Makers."

CROMPTON PARKINSON, LTD., Bush House, London, W.C.2.—Particulars of revised discount rates for "Crompton" lamps. Also a revised lamp price list.

L. G. HAWKINS & CO., 30-35, Drury Lane, Kingsway, London, W.C.2.—A folder, illustrating the new model "Savage" health motor. Also list No. 931, dealing with electric fans, and the May issue of "The Link."

J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham.—Folder G9/C, containing reduced trade prices of "Titan" switches and ceiling roses.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—An illustrated booklet giving a description and history of "A.C.E.C." cables.

SILAS QUAKER, LTD., 110, Park Street, Camden Town, London, N.W.1.—A booklet describing and illustrating "Quakerlight" lighting fittings.

HIGGS MOTORS, Witton, Birmingham.—The May stock list of "Higgs" electric motors.

RADIO INSTRUMENTS, LTD., Purley Way, Croydon.—A 40-page catalogue of "R.I." radio receivers and components. Also a leaflet dealing with mains transformers for rectifying valves and Westinghouse metal rectifiers.

THE ASSOCIATED EQUIPMENT CO., LTD., Windmill Lane, Southall, Middlesex.—An illustrated booklet, giving particulars of "A.E.C.-English Electric" trolley 'buses.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Publication No. P.262 (replacing P.205), relating to the "Prescot" wiring system.

ELECTRIC FIRES, LTD., Heatrae Works, Norwich.—A folder, illustrating "Heatrae" electric water heaters.

X-RAYS, LTD., 47, Red Lion Street, High Holborn, London, W.C.1.—A circular illustrating various portions of the company's X-ray apparatus factory.

RADIOVISOR PARENT, LTD., 28, Little Russell Street, London, W.C.1.—Particulars of the "Radiovisor" system for indicating the presence of smoke in chimneys.

The MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, London, W.1.—Four window bills in connection with the company's summer sales campaign.

Prices of Materials

Messrs. F. Smith & Co. report May 19th: Copper (electrolytic) bars, sheet and wire rods, no change; ditto ditto h.c. wire, 7 7/16d., ¼d. decrease; silicium bronze wire, no change.

Messrs. Edward Till & Co. report, May 19th: India-rubber, Para fine, 4¼d., ¼d. inc.

Messrs. James & Shakespeare report, May 19th: Copper bars (best selected), sheet and rod, £73, £2 dec. English pig lead, no change.

Unemployment

The number of persons on the registers of Employment Exchanges in Great Britain increased by 2,676 during the week ended May 11th. At that date the total was 2,532,511, as compared with 2,529,835 on May 4th and 1,739,485 on May 12th, 1930.

Australian Tariff Changes

A new Customs tariff schedule just introduced by the Australian Government includes a few items of electrical equipment. Increased duties are imposed on the following:—Combined power transformer and choke, from 20s. to 30s. each British preferential tariff, 22s. 6d. to 35s. intermediate tariff, and 25s. to 40s. general tariff; electric wall plugs, from 27½ per cent. *ad valorem* to 35 per cent. British, 35 to 50 per cent. intermediate, and 40 to 55 per cent. general; cotton-covered cable and wire from 25 to 30 per cent., 30 to 40 per cent., and 40 to 45 per cent. Household vacuum cleaners, which were previously admitted free under all three classifications, are still the same under the British and intermediate tariffs, but a duty of 15 per cent. is placed on them under the general tariff. There is a decrease in the duty on Leclanché cells. These have hitherto been admitted at duties of 7d., 9d. and 10d. each, but the new duties are 27½ per cent., 35 per cent., and 40 per cent., respectively.

Visit to Reyrolle's Works

The latest developments in electrical engineering were shown to a party of 28 prominent French electrical engineers, who paid a visit to the works of Messrs. A. Reyrolle & Co., Ltd., Hebburn, this week. The visitors made a two days' tour of the works of Messrs. Reyrolle and the works of Messrs. J. H. Holmes & Co., Ltd., an associate company of Messrs. Reyrolle. The party are in England on the invitation of Messrs. Reyrolle and of Messrs. Merlin & Gervin, of Grenoble, also an associate concern. The visitors were accompanied on the second day by the Lord Mayor of Newcastle. On Tuesday they were conducted round the erecting shops and through the testing sheds. In the latter they witnessed the testing of oil-circuit breakers by means of the company's up-to-date plant. The electrical switchgear for which the company is noted was also examined, particular interest being evinced in the extra-high-voltage, outdoor metalclad gear. In the works of Messrs. J. H. Holmes & Co. the party was shown the latest developments in variable-speed a.c. commutator motors, and work in hand for large London daily newspapers, including electrical control equipment for printing presses.

The International Lamp Cartel

It is reported that the International Incandescent Lamp Cartel, which was established in 1925 for a period of ten years, is to be extended until the end of 1954. The leading concerns in the Cartel are Philips Glowlampworks (Holland), the German Osram Gesellschaft, and the General Electric Co. of America.

B.S.S. for Brazing Solder

The British Engineering Standards Association has recently published a revised issue of British Standard Specification No. 263 for Brazing Solder. This new edition has been prepared in order that an additional grade, intended primarily for solder supplied in the form of slittings and wire, might be incorporated. This grade is designated AA, and the three grades now covered by the specification are accordingly AA, A, and B. Another point of difference between the new issue and the one superseded is that the dimensions of certain of the sieves for testing granular solder have been modified, so that they might be in exact agreement with the dimensions in the recently-published B.S.S. for test sieves (No. 410). Copies of the new Specification (B.S.S. No. 263-1931) can be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Altrincham Electric Railway

Under the above heading last week (p. 828) we included an illustration of a B.T.-H. track-feeder high-speed circuit breaker equipment at Old Trafford sub-station. The caption should be so worded instead of "Remote Control Panel."

Private Arrangement

M. HAAR (Fleet Electric Service), electrical and wireless engineer and dealer, Ivy Lane, Ludgate Hill, London, E.C.—A meeting of creditors was held recently at the offices of Messrs. Hacker, Rubens, Gotelee & St. Clair, 329, High Holborn, London, W.C., when Mr. Hacker stated that the liabilities were approximately £385 and there were no assets. It was possible that the liabilities might be increased by between £20 and £30. An offer was made of 2s. in the £, suitably guaranteed, payable as to 1s. in six months, and 1s. in twelve months. The meeting terminated, however, without any definite resolutions being passed.

Winding-up Petition

JOHNSON & BOLSOM, LTD.—A petition for the winding-up of this company was presented to the High Court on May 11th by Mr. H. T. Hobbs, and will be heard in London on June 8th.

Dissolutions of Partnership

DOWNWARD & MACKERETH, wireless engineers, Cavendish Street, Ulverston.—Mr. F. B. Holmes-Higgin and Mr. G. H. Mackereth have dissolved partnership. Mr. Mackereth will attend to debts, and the business will be carried on as "Downward & Mackereth, Ltd."

H. E. DALLY, electrical contractors, 129, High Road, Balham, S.W.—Mr. C. F. Batterbee and Mr. H. E. Dally have dissolved partnership. Mr. Dally will attend to debts and carry on the business.

Bankruptcy Proceedings

S. NICHOLLS, electrical engineer (trading as Electrical Wireless and Gramophone Supply Co.), 151, Marlowes, Hemel Hempstead, Hertfordshire.—The receiving order was made on the debtor's own petition recently. His statement of affairs shows liabilities of £2,520 and assets of £3,284. After allowing £90 for preferential claims, the net assets are £3,194, leaving a surplus of £673. The debtor attributes his failure to "becoming jointly and severally liable under guarantees given to bankers on behalf of a limited company, and to insufficient turnover to cover expenses." The debtor states that in April, 1929, he entered into partnership with another at the above address as electrical engineers. All the capital of £750 was provided by the debtor, but the partnership was not successful, and was dissolved in May, 1930. The debtor agreed to take over the liabilities and assets, amounting to £943 and £381, respectively, and has since traded alone. A meeting of creditors was held in July last, when it was agreed to allow him a further six months' credit provided he raised £200 for distribution. He was unable to do this, and filed his petition. The debtor became aware of his position in June, 1930.

F. MOORE, electrical contractor (trading as Frank Moore and Sons), 34, Victoria Gardens, Horsforth, Yorkshire.—The receiving order in this case was made recently on the debtor's own petition. The first meeting of creditors was held at the Official Receiver's office, 24, Bond Street, Leeds. According to the statement of affairs filed there were liabilities of £180 and assets of £4. The case, being a summary one, was left in the hands of the Official Receiver as trustee. The following are creditors:—

	£		£
G. Casperson	43	General Electric Co., Ltd.	20
Elecl. Components, Ltd.	48	Sun Electrical Co., Ltd.	20

E. C. G. HEFTI, electrician, 10, Dean Road, Scarborough, Yorkshire.—The adjourned public examination was held recently at the Court House, Castle Road, Scarborough. The debtor's statement of affairs showed a deficiency of £662. It appeared that in August last year the debtor formed a limited company at Filey, and he attributed his failure to the fact that the South-East Yorkshire Light and Power Co., Ltd., did not deliver electrical energy in that month as promised. The examination was closed.

D. O. CLARKE, wireless and gramophone dealer, 53, Bletchley Road, Bletchley.—Receiving order made May 12th on the debtor's own petition.

G. F. A. STONE, electrical accessories manufacturer (trading as Stone Manufacturing Co.), 108, Great Saffron Hill, London.—Trustee, Mr. Ferrars Vyvyan, Official Receiver, released May 6th.

W. ADAMS, electrical engineer (trading as Electrovacs), 120, Victoria Street, London.—Last day for receiving proofs of dividend, May 29th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, London, E.C.1.

F. J. WELBERRY, electrician, 4, Maud Foster Terrace, Skirbeck.—Last day for receiving proofs of dividend, May 30th. Trustee, Mr. F. C. Brogden, 10, Bank Street, Lincoln, Official Receiver.

E. L. PRATT, electrical engineer, 5, Nowel Mount, Harehills, Leeds.—Receiving order made May 7th on debtor's own petition.

A. PARSONS, electrician, 23, Clifton Crescent South, Rotherham.—Receiving order made May 7th on debtor's own petition.

W. F. O. SEWELL (Commercial Electrical Co.), electrical engineer, 24, James Street, Bradford.—Last day for receiving proofs for dividend May 27th. Trustee, Mr. J. O. Morris, 12, Duke Street, Bradford, Official Receiver.

S. B. WATSON (S. B. Watson & Co.), electrical engineer and contractor, 73, Crouch Street, Colchester.—Last day for receiving proofs for dividend, May 27th. Trustee, Mr. H. S. Gotelee, 9, Arcade Street, Ipswich, Official Receiver.

J. TUCKER (Bristol Radi-ator Co.), wireless dealer, 30, Lower Ashley Road, Bristol.—First and final dividend of 2½d. in the £, payable May 16th at the Official Receiver's office, 26, Baldwin Street, Bristol.

CORRECTION.—MR. THOMAS H. SMERDON, electrical engineer, who has been in trade at 302, Kentish Town Road, N.W.5, for the past eight or nine years, asks us to state that Mr. F. A. Coulson, wireless dealer, had not been in business at that address, as was reported in our last issue.

Company Liquidations

EDWARD HOLME & CO., LTD.—Particulars of claims by June 15th to the liquidator, Mr. R. N. Carter, 16, Kennedy Street, Manchester.

HARGROVE STANLEY, LTD.—Meetings, June 15th at 3, Wood Street, Queen Square, Bath, to receive an account of the winding up by the liquidator, Mr. H. O. Johnson.

EVERLITE, LTD.—Winding up voluntarily. Particulars of claims by June 30th to the liquidators, Mr. F. H. W. Hope and Mr. H. Hackett, Pinners Hall, Austin Friars, London, E.C.2.

ELECTRICAL UTILITIES, LTD.—Winding up voluntarily. Liquidator: Mr. F. S. Mills, of the company.

CONSTANT POTENTIAL TRANSFORMER SYNDICATE, LTD.—Meeting June 15th, at 3, Lombard Court, London, to receive an account of the winding up.

Electricity Supply

Lighting, Domestic, Power

Alaska.—HYDRO-ELECTRIC DEVELOPMENT.—A hydro-electric scheme costing approximately £600,000 is to be carried out on the Davis River by the Portland Canal Company.

Australia.—MELBOURNE.—We have received from Mr. W. H. Alabaster, city electrical engineer, a copy of his annual report, together with a statement of accounts, for the year ended December 31st last. The total revenue amounted to £588,741, as compared with £620,800 in the preceding year, while the working expenses were £341,745, as against £351,400. The gross profit thus declined from £269,399 to £246,996, and after deducting capital and other charges there was a net surplus of £116,040 (£136,979). A contribution of £45,000 was made to the town fund. Capital expenditure during the year amounted to £122,309, the principal items being:—Mains, £54,371; public lamps, £17,385; switchboards and instruments, £17,282; sub-stations and transformers, £11,719. The sales of electrical energy decreased from 89,634,022 to 87,335,027 kWh, and the maximum demand from 36,500 to 33,400 kW. The average revenue per kWh sold dropped from 1.663d. to 1.618d. Schemes of improved lighting were carried out during the year in many streets, and the work of extending the ornamental lighting system in various parts of the city is proceeding.

Bexhill.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £3,000 for the purchase of meters.

Bradford.—SUPPLY TO HOUSING ESTATE.—The Corporation Housing Committee is to install electricity in 770 houses on the Chellow Grange estate.

Bucklow.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Mid-Cheshire Electricity Supply Co., Ltd., to supply electricity in part of the rural district of Bucklow.

Burton-on-Trent.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains to supply Overseal sewage pumping station at an estimated cost of £445.

Canada.—ELECTRICAL DEVELOPMENT IN SASKATCHEWAN.—The annual report of the Saskatchewan Power Commission shows that the Provincial Government is now operating 1,151 miles of transmission lines, all but 55 miles of which were built last year. The total capital investment by the Commission is now upwards of $6,500,000. At the close of 1930 the total capital assets of the Commission stood at $6,484,403, and in addition $743,102 was set aside for sinking fund and other reserves. Last year the Commission operated three large plants and 66 small plants and distributing systems, and sustained a small operating loss of $946, making a total deficit of $1,126 for the first two years of operation. The Commission's principal generating station is the steam-electric plant acquired two years ago from the Saskatoon City Council, and subsequently enlarged. The Commission, however, has purchased more plant and equipment in 35 different towns and entered into agreements with 87 towns and villages for the supply of electricity. The total generating capacity of plants owned by the Commission is 26,325 kW, while the capacity of municipally-owned plants in the province is 37,024 kW, and that of all privately-owned plants 29,227 kW. Of the Commission's generating plant 21,925 kW is operated by steam and 4,400 kW by oil. This statement does not take into account the large hydro-electric power development of the Churchill River Power Company at Island Falls on the Churchill River. The Commission is considering the development of hydro-electric power at a site near Fort à la Corne on the North Saskatchewan River, 17 miles north-east of Kinistino. Electricity generated by the Commission now serves 106 urban centres, 95 of which were connected in 1930. Last year approximately $3,200,000 was expended by the Commission, the expenditure contemplated for the current year being estimated at $1,000,000.

Canterbury.—CHANGE-OVER.—In connection with the change-over scheme, the City Council has applied for sanction to a loan of £7,150 for laying e.h.p. feeder cables, distributing mains, l.p. cable, and providing transformer kiosks in the Main Street and on North Holmes housing estates. The cost of carrying out alterations to consumers' apparatus is to be paid out of revenue.

Continental.—GERMANY.—A return just to hand shows that the output of the 122 principal electric supply undertakings in Germany during February last amounted to 1,208,100,000 kWh, bringing the total for the first two months of the year to 2,565,300,000 kWh, as compared with 2,958,200,000 kWh in the corresponding period last year.

BELGIUM.—The municipal authorities of Brussels have decided to adopt electricity in place of gas for the lighting of a large number of additional thoroughfares of the city during the present year, a sum of £24,400 being provided in the 1931 Budget for this work.

Croydon.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at an estimated cost of £2,665.

SUPPLY TO WHITGIFT SCHOOL.—A supply of electricity is to be given to the new Whitgift School, South Croydon, at a cost of £695. The Whitgift governors will build the requisite sub-station.

Dorchester.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to a loan of £2,500 for the purchase of plant.

Ealing.—EXTENSION SCHEME.—The Town Council is to apply for sanction to a loan of £20,000 for the provision of electricity in the Priory Park estate, Hanger Hill Garden estate, Haymills estate (Hanger Hill golf course), the London and Provincial Building Company's estate between Fowler's Walk and Hanger Lane, and the Greystoke estate. It will be necessary for this scheme to erect seven new sub-stations.

Eastbourne.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £4,240 for new sub-stations and £18,561 for mains.

RE-WIRING OF WINTER GARDEN.—The Corporation Devonshire Park Committee has further considered the necessity for re-wiring the Winter Garden, &c., and improving the lighting, and has asked the Electricity Committee for the same facilities as are provided in connection with the rental wiring scheme, so that the work may be carried out immediately. The estimated cost of the work is £700.

Eccles.—ASSISTED WIRING.—At the May meeting of the Town Council it was reported that the Public Lighting and Electricity Committee had met representatives of seven local contractors for the purpose of discussing the assisted wiring scheme, and the activities of the new showrooms about to be opened. The representatives appeared to be well satisfied with the manner in which the Committee proposed dealing with the question of assisted wiring and the sale or hire-purchase of electrical appliances, and the Committee was to work hand in hand with the local contractors.

Edenbridge.—INAUGURATION OF SUPPLY.—A supply of electricity was inaugurated on May 11th by the Kent Electric Power Co.

Glasgow.—PRICE REDUCTIONS.—The Corporation Electricity Committee recommends reductions of charges, resulting in the saving of approximately £80,000 per annum to commercial and industrial consumers. The primary rating assessment of the commercial lighting tariff is to be reduced from 500 hours' to 400 hours' use during the survey year. In connection with the commercial services tariff, the total annual fixed charge component is to be not less than £200, while the running charge component is to be reduced from ¾d. to ½d. per kWh. Reductions are also proposed for industrial power at stipulated rates.

MAINS EXTENSIONS.—The Corporation Electricity Committee recommends the laying of distributing mains at a cost of £4,072.

Gravesend.—WATER HEATING.—The Corporation Electricity Committee recommends the introduction of a reduced charge for water heating during night hours.

Hazel Grove and Bramhall.—ASSISTED WIRING.—The Urban District Council is considering two schemes for the assisted-wiring of premises, one of which is for quarterly payments and the other by prepayment meters. The electricity manager is to furnish a report on a special tariff for shopkeepers and other extensive users of electricity.

India.—RURAL ELECTRIFICATION IN MYSORE.—It is reported by our Indian Correspondent that, as part of the rural electrification scheme, which is being vigorously pursued by the Government of Mysore, the Anekal line has now been electrified and a special officer is to be appointed for the purpose of popularising the use of electric power in rural areas. It is expected that the electrification of the rural areas of the state will be completed within the next five years.

Isle of Man.—ELECTRICITY SCHEME.—The Manx Legislature, having definitely set its face against the provision of an island electricity scheme administered by a private company, means are being considered as to how a Board of the Manx Government can best put a scheme into operation. Apparatus has been installed in the Sulby river, the island's largest water course, with a view to measuring the flow of water, and ascertaining if the flow is sufficient to warrant the establishment of hydro-electric plant. When these facts have been definitely established, the question of the use of steam or water power will be decided, and the Government of the island will be asked to put up the capital cost as an unemployment scheme.

Japan.—NEW POWER STATIONS.—The Toho Power Company is contemplating the erection of a 20,000-kW auxiliary power-station on the Nagara River. Application has also been made to the Government by the Ujigawa Electric Company for permission to erect three new power stations at Totsugawa (8,850 kW), Nagatono (8,315 kW), and Iketogo (756 kW).

Kidderminster.—LIGHTING OF INSTITUTION.—The Worcestershire County Council is to install electric lighting at the Kidderminster Institution.

London.—FULHAM.—The Borough Council has received sanction to the borrowing of £680 for sub-station buildings and site, £1,585 for mains and £577 for sub-station equipment.

During the year ended March 31st last the electricity sold by the Electricity Department was 23,283,438 kWh, an increase of 2,044,275 kWh as compared with the preceding year. The income from sales of electricity, excluding meter rents, &c.,

amounted to £161,012 (subject to discounts), as against £144,748 in 1929-30. During the year 3,156 new consumers were connected, 2,226 of whom took advantage of the assisted wiring scheme. The total number of consumers at the end of March was 147,343.

ST. PANCRAS.—The extension of mains costing £524 is recommended by the Borough Council Electricity Committee.

ST. MARYLEBONE.—The Borough Council has received sanction to a loan of £45,867 for cables, switchgear, and transformers.

STOKE NEWINGTON.—The extension of mains costing £316 is recommended by the Borough Council Electricity Committee. Free wiring installations costing £580 are also to be carried out.

Paisley.—PREPAYMENT METERS.—The Corporation Electricity Committee is considering the use of prepayment meters.

Philippine Islands.—HYDRO-ELECTRIC DEVELOPMENT.—Work has recently been completed on the construction of a hydro electric power station for the Manila Electric Co. to utilise the power of the River Botocan at the foot of Mount Banahao. Energy is transmitted to Manila, a distance of about 55 miles, by a 110,000-V transmission line erected on steel masts. Provision has been made so that constant communication can be carried on between the Manila and Botocan power stations and *vice versa* by means of carrier current equipment which allows the engineers to speak directly over the h.p. transmission line, and maintain complete control of the operations at both plants.

Purfleet.—OVERHEAD LINES.—The Urban District Council has given permission to the County of London Electric Supply Co., Ltd., to erect overhead lines for the supply of electricity to Council houses at South Ockendon.

Shipley.—LOAN SANCTIONED.—The Urban District Council Electricity Committee has received sanction to a loan of £10,000 for mains.

Siberia.—NEW POWER STATION AT KEMEROVO.—Work has recently been commenced on the construction of the first regional electric power station in Kemerovo, Siberia, which is to have a capacity of 560,000 kW. The electric transmission lines will extend about 54 miles to the north and 90 miles to the south.

Stirlingshire.—ELECTRICITY SUPPLY.—A movement is afoot to introduce electric lighting in the villages of Balfron and Killearn, which are included in the Grampian scheme.

Stockport.—ASSISTED WIRING.—At a recent meeting the Town Council approved the introduction of an assisted-wiring scheme. The work is to be executed by local electrical contractors and the electrical engineer is to arrange with the contractors the price per point.

POWER STATION EXTENSIONS.—The Town Council proposes to install additional plant at the Millgate generating station at an estimated cost of £42,984.

Swansea.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a total cost of £790.

Tain.—SUCCESSFUL FIRST YEAR.—At a recent meeting of the Council the chairman of the Electricity Committee stated that the electricity undertaking for the first year had been more satisfactory financially than had been anticipated. After meeting all liabilities a small profit had been obtained, and he strongly advised the Council in order further to popularise the use of electricity in the burgh, to reduce the charges by 25 per cent. This recommendation was unanimously adopted. The consulting engineers for this scheme were Messrs. A. Hugh Seabrook & Partners.

Tynemouth.—LOAN.—The Corporation Electricity Committee is to apply for sanction to the borrowing of £10,000 for mains and services.

Warrington.—ASSISTED WIRING.—The Corporation Electricity Committee has approved the following prices quoted by the electrical contractors for work in accordance with the Electricity Department's specification for assisted wiring: Lighting point, £1 1s. 7d.; two-way switching, 11s. 3d. extra; five-amp. plug point, £1 1s. 7d.; 15-amp. plug point, £1 17s. 4.

Watford.—PRICE REDUCTIONS.—The Town Council has made the following alterations in its electricity tariff: Lighting: First 30 kWh in each of the December and March quarters, and the first ten kWh in each of the June and September quarters reduced from 6d. to 5d. per kWh; all additional energy for lighting, including outside shop lighting, reduced from 3d. to 2½d. per kWh. Lighting on the two-rate system or under the bulk supply tariffs is to be reduced in proportion to the power scale. Lighting through prepayment meters: A reduction from 7½d. to 6½d. per kWh. Power and heating, including special heating rates: The rebate of 20 per cent. increased to 30 per cent. Power, including bulk supply: A decrease of 12½ per cent. on present rates.

Whitefield.—SUPPLY TO HOUSING ESTATE.—The Urban District Council has given permission to the Lancashire Electric Power Co. to arrange for electricity to be supplied to tenants on the Elms housing estate on the following terms: Parlour-type houses, 5d. per week for eleven years; non-parlour type houses, 4d. per week for eleven years. The cost is to be recovered with the rent, and the Council will make the necessary payments to the company for the installations.

Traction

Australia.—BRISBANE.—The accounts of the City Tramways Department (general manager: Mr. G. R. Steer) for the year ended December 31st last show a total revenue of £766,271 and a working expenditure of £552,661, leaving a gross profit of £213,610. The previous year's figures were:—Total income, £794,470; working expenses, £584,390; gross profit, £210,080. After providing for capital and other charges there was a net surplus of £8,756, as compared with £7,606 in 1929. The number of passengers carried declined from 76,117,084 to 73,616,854 and the car mileage from 6,616,426 to 6,575,754. The revenue per car mile fell from 28.31d. to 27.50d. The extension from Rosalie to Rainworth was opened in October last, and four one-man cars have now been placed in operation.

Bridlington.—AUTOMATIC TRAFFIC CONTROL.—The Town Council has decided to erect a number of automatic signals at dangerous corners and at the approaches to the town. The Council also proposes to ask the East Riding County Council to erect a number of signals at the corners of roads for which it is responsible.

Continental.—FRANCE.—Motor-'buses are to be substituted for trams on further tramway routes in the centre of Paris.

GERMANY.—The electrified section of the railway between Munich and Augsburg was put into operation on May 11th. The Salzburg-Munich-Augsburg line, the whole of which is now electrified, is 133 miles in length and forms an important part of the great international connection between Vienna and Paris which it is proposed eventually to electrify. With the conversion of the Munich-Augsburg line the length of track electrically equipped in South Bavaria is 1,054 miles, with a route length of 477 miles. It is calculated by the Reich Railway authorities that the annual saving in locomotive coal on the Bavarian electrified network before the opening of the Munich-Augsburg section amounted to 140,000 tons, while 600 fewer employés, including locomotive men, were needed to handle the traffic. The consumption of energy for the propulsion and heating of the trains is estimated at over 100,000,000 kWh per annum, which is supplied from the Walchensee works and the works on the middle Isar.

BELGIUM.—The Minister of Communications is reported to be engaged on the preparation of plans for the electrification of a part of the Belgian railways, and a corresponding Bill is to be shortly placed before the Lower Chamber. The question concerns the conversion of the lines between Brussels and Arlon, Brussels and Antwerp, and Brussels and Jemelle.

India.—FIRST METRE-GAUGE ELECTRIC TRAIN SERVICE INAUGURATED.—According to *Indian Engineering*, H.E. the Governor of Madras recently inaugurated the suburban electric service of the South Indian Railway Company from Madras Beach to Tambaram. This is the first metre-gauge line in India to be electrified, and the S.I.R. is the first in the Madras Presidency to be operated electrically. The whole scheme comprises the construction of two additional lines between Madras Beach and Tambaram (17 miles), doubling the single main line between Tambaram and Chingleput (19 miles), and doubling the entire track from Tambaram to Madras Egmore. Electrical energy for the service is for the present supplied by the Madras Electric Supply Corporation.

Japan.—RAILLESS CARS.—The introduction of a railless-car system in Nagoya is being considered by the Municipal Electric Bureau.

London.—TRAMWAY FINANCES.—Submitting the tramway estimates (ELEC. REV., May 15th, p. 840) at a meeting of the London County Council held last week, Mr. F. B. Galer, chairman of the Highways Committee, said that the surplus on the past year's working amounted to £755,285, a decrease of £69,317 on the original estimate. This somewhat disappointing result was due, he said, to trade depression and unfavourable weather; also, when the estimates were framed, unemployment was not nearly so severe. The estimated surplus for the coming year was £63,804. All the unreconditioned cars were to be taken off and 110 new cars provided. In five years' time debt charges would be £243,000 lower and in ten years' time £408,000 lower.

South Africa.—MAIN LINE ELECTRIFICATION IN NATAL.—A start has been made with the electrification of the Natal main line between Cato Ridge and Pietermaritzburg, a distance of 28 miles. With the line from Pietermaritzburg to Glencoe which is already electrified, this will make a total of 202 miles. The new extension is expected to cost about £75,000. The Union Railways Department will erect the transmission lines and overhead equipment, and the sub-station and other auxiliary plant work will be carried out by the Electricity Supply Commission.

Stockton.—'BUS LICENCE CONDITIONS.—As a result of an appeal made by the General County Omnibus Co. against the licence conditions which the Town Council sought to impose, primarily for the protection of the Council's tramway undertaking, the Ministry of Transport has decided in favour of the Omnibus Company and has suggested the substitution of a condition under which the company should charge at least one penny above the tramway fares on certain routes in the town. It was stated that the Council was losing about £1,000 per month on the tramway system.

Telegraph and Telephone

Denmark.—TELEGRAPHY.—The annual report of the Great Northern Telegraph Co., Ltd., of Denmark, shows that in 1930 23 faults occurred in 11 cables in Europe, and 31 in 11 cables in the Far East. The company's route through Siberia consists of two circuits between Leningrad and Vladivostock, placed at its exclusive disposal by the Commissariat for Posts and Telegraphs for the transmission of traffic in connection with its cables landed in the U.S.S.R. Telegrams between Europe and the Far East are now subject to one retransmission only between Leningrad and Nagasaki (*viz.*, at the company's Irkutsk station), effected entirely by automatic instruments. The total number of words passing over the route was somewhat smaller in 1930 than in 1929. In China the fall of 33½ per cent. in the exchange value of the dollar adversely affected the company's revenue from local traffic. Agreements with the Chinese Government expired at the end of 1930 (the Eastern Extension Australasia & China Telegraph Co. and the Commercial Pacific Cable Co. also participated) and not until the last day of the year did they succeed in reaching a preliminary agreement with the Government on the principal points of their new concessions. The tariff agreements of 1913 between the Japanese Government and the company expired at the end of 1930; their determination has, however, no influence on the service itself, which is being carried on as hitherto. Several Governments from which the company holds concessions have opened, or contemplate opening, wireless services in competition with the company's cables. The latter questions whether it pays them financially to do so, and whether the time is not coming when there will be too many international telegraph routes altogether, by wire or by radio. Traffic receipts and profit from participation in other telegraph undertakings show a very considerable decrease (roughly £125,000), the principal reason being the falling off in telegraph correspondence generally, and it has been necessary to transfer to the revenue account from interest on the reserve fund £166,666, which will enable the Board to propose a dividend of 20 per cent.

International Telephony.—ANGLO-NORWEGIAN SERVICE.—The British Postmaster-General announces that, in order to meet the continued growth of telephone traffic between this country and Norway, a direct circuit between London and Oslo has been brought into service. Calls have hitherto been switched at Malmö in Sweden.

Poland.—TELEPHONE CONTRACT.—The Polish Ministry for Posts has practically concluded negotiations with a British company for the construction of new telephone lines at a cost of £2,000,000. The agreement, to be on a long-term credit basis, is to be ratified at a special session of the Polish Diet in the near future.

Russia.—MARINE RADIO.—Foreign ships in Russian waters are in future forbidden to use wireless communication without permission from the Soviet. According to the *Morning Post* the only occasions on which a foreign ship may use her wireless apparatus without permission will be either when she is in need of assistance for herself or is answering an S.O.S. from another ship.

Radio Beacons.—SCOTLAND.—A new signalling radio beacon has been installed on May Island in the Firth of Forth. During fog the set will transmit a beam once every four minutes on a wavelength of 1,000 metres at a rated power of three kilowatts. The radius of the beam's signal is given as about 30 miles.

GOOLE.—An experiment in fog signalling is to be carried out on the River Ouse at Blacktoft, about ten miles from Goole, where Messrs. Chance Bros. & Co., Ltd., are erecting a small wireless transmitting station, which will emit a wave which will be picked up by a receiving set at Faxfleet Ness, a danger point further down the river, and automatically operate a fog horn.

U.S.A.—The use of combined radio and sound signals to permit navigators to calculate their distance from definite objects, even in fog, without a special radio compass, which has been successfully operated along the Atlantic coast and the Great Lakes, is shortly to be tried on the Pacific coast. The spot chosen for the initial test is Blunts Reef lightship, near Cape Mendozino, California.—*Reuter's Trade Service* (New York).

South America.—QUICKER TELEGRAPHY.—A special service for speeding-up cablegrams between London and important centres in Argentina and Brazil is now in operation. Introduced by Imperial and International Communications, Ltd., in conjunction with its associated company in South America, the Western Telegraph Company, it involves no extra expense and telegrams can, for example, be delivered in London, 7,500 miles away, in from one minute to a minute-and-a-half, which performance is made possible by elaborate telephone arrangements at the transmitting and receiving stations.

United States.—POLICE RADIO.—The United States Government's Wireless Commission reports that wireless is coming into general use as an aid to the police in many States and cities. More than 60 cities already possess, or are constructing, systems which place police headquarters in communication with patrol cars.

Radio

Ceylon.—NEW PLANT.—The Colombo broadcasting station is situated at Welikade on the outskirts of the town. At present the ordinary coast station is modulated for broadcasting purposes, but a new transmitter is nearing completion which will be used solely for broadcasting, and, it is hoped, will deliver approximately 2 kW to the aerial. A c.w. telegraph transmitter is also in operation in the same building, and it is hoped shortly to modulate this, and carry out experimental short-wave broadcasts of the Colombo programmes. According to *World-Radio*, the number of licensed listeners is not more than 1,600. A considerable amount of receiving apparatus is imported which is totally unsuited to the climatic conditions, and the Post Office engineers are drawing up specifications for standard receivers specially adapted for tropical reception, and dealers will be requested to restrict their sales to similar apparatus. Perhaps the most popular broadcasts are the relays of G5SW, which are carried out frequently. A special receiver for the reception of the British transmitter and a special aerial, tuned to a wavelength of 25 metres, are in course of erection.

Italy.—NEW STATION.—Test-transmissions from the new Palermo station will take place towards the end of the month, for the present at any rate, on a wavelength of 453.2 metres, an international common wave used in Italy by the little station of Bolzano.

Canada.—LICENCES.—Radio sets are increasing at the rate of about 100,000 a year and now equal one to every 19 of the population. Licensed receiving sets at the end of March totalled 514,701, an increase of 90,555 over the number registered on March 31st, 1930. Ontario had about half the number with 257,275, then followed Quebec, 94,883; British Columbia, 42,726; Saskatchewan, 33,516; Manitoba, 32,989; Alberta, 23,660; Nova Scotia, 16,530; New Brunswick, 16,530; Prince Edward Island, 1,255; North-West Territories, 146. Toronto was at the top of the list among the cities with 80,342 sets, Montreal coming next with 44,059. Every owner of a set is required to pay a licence fee of one dollar to the Government. To detect and check causes of interference that prevent satisfactory reception motor cars with special equipment are maintained by the Government in several centres and sent out to find the cause of the trouble.—*Reuter* (Ottawa).

LICENCE LEGISLATION.—The Government has amended the Canada Evidence Act, which constitutes a threat to owners of receiving sets who fail to procure the necessary licences. Hitherto the Government has been deterred from prosecuting such offenders because of the labour of proving that licences have not been obtained, but now, says *World-Radio*, an affidavit from the Government Radio Department stating that the person accused has no licence is to be *primâ facie* evidence that he has not. In cases in which individuals do not dispute the charge it will eliminate the calling of witnesses to prove the allegation.

Wireless and the Blind.—The B.B.C. announces that £15,000 is needed to provide wireless equipment for blind persons who are still without listening facilities. The Prince of Wales has been president of the British Wireless for the Blind Fund since its inception at Christmas, 1929, since when a sum of £31,000 has been collected for the supply of receivers to blind persons throughout the country. Some 13,000 sets, complete with aerial equipment, have already been distributed and a further 1,000 sets are waiting to be installed in homes in the north of England as soon as the new north regional transmitter is in full service. Donations, however small, may be sent to the British Wireless for the Blind Fund, 226, Great Portland Street, London, W.1.

Magnetic Recorder.—B.B.C. USE.—A machine which will retain a record of all that is spoken or done over the wireless has been put into official experimental use by the B.B.C. It carries the spoken record in the form of magnetic impressions on a long steel tape, which winds itself on to a spool; a programme just recorded can be reproduced and, if desired, rebroadcast at a moment's notice.

Italy.—NEW TRANSMITTERS.—At a recent joint meeting of the Ministry of Transport and the broadcasting authorities, it was decided to erect in Milan a new transmitter having a power of from 50 to 60 kW, to be ready for service by March, 1932. Florence is to have a 20-kW transmitter, to be ready by October 20th, 1931, and at Bari a new 20-kW station is to be ready by April 21st, 1932. In July of this year, Philips Lamps, Ltd., inform us, the power of the Genoa transmitter is to be increased to 10 kW, while the Bozen transmitter is to have six times as much power by October 28th next.

Reception.—EARTHQUAKE'S EFFECT.—It would seem that an earthquake, or impending earthquake, can have a detrimental effect on radio reception. According to Philips Lamps, Ltd., when the recent New Zealand earthquake took place many amateurs who at the time were experimenting with short waves experienced strange phenomena which made reception impossible. The radio operator of an American expedition in the Arctic reports that the aurora borealis adversely affects medium-wave broadcasting. As soon as the aurora became apparent a great many stations usually received at full strength became almost inaudible. A noticeable feature of the phenomenon was that short-waves did not appear to be affected.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—Sydney (N.S.W.).—Government Railways. One 2,500-kW alternator for Lithgow power station. The date for reception of tenders has been extended from April 8th to July 8th. (A. 10904.)*

Belgium.—Schaerbeeck.—May 28th. Administration Communal. 7,000 m. of h.p. armoured cable and 500 m. of l.p. armoured cable. Particulars from Service de l'Electricité, Hôtel Communal (2e étage), Schaerbeeck.

Bridlington.—June 10th. Corporation. Conversion of distribution system from d.c. to a.c. (See this issue.)

Cheadle and Gatley.—June 9th. Electricity Department. 125-kVA transformer kiosk. (See this issue.)

Chile.—Santiago.—June 30th. State Supplies Department. Electric wire. (C.X. 3550.)*

Coseley.—June 15th. Education Committee. Installation of electric lighting in five schools. (See this issue.)

Dunfermline.—May 30th. Fife County Council. Electrical work at new High School, Dunfermline. Schedules (deposit £2 2s.) from Messrs. C. R. Douglas & Son, Prudential Buildings, East Port, Dunfermline.

Egypt.—Cairo.—June 24th. Ministry of the Interior. Overhead line material including 81 tubular poles, 1,250 kilos of bare copper cable, 715 kilos of bare copper wire and 320 insulators. (A.X. 10891.)*

July 5th. Pumping equipment, installation of telephone system, &c., at Damietta. (G.X. 10369.)*

July 6th. 380 steel tubular poles, 2,000 kilos of bare copper wire, junction boxes and 695 meters. (A.X. 10907.)*

July 11th. Electric power station at Mansourah, including Diesel-driven alternators, switchgear, transformers, pumping sets, and a 40-ton crane. (A.X. 10910.)*

June 15th. Ministry of Public Works. Electrically-driven pumping plant for El Arisk. (G.X. 10370.)*

Hull.—Corporation Telephone Committee. Automatic table telephones. (May 15th.)

Lancaster.—Electricity Department. Overhead line between Halton and Caton. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—May 27th. Site works, foundation works, and buildings at Northampton, Ironbridge, Wolverhampton, Stafford, and Stoke-on-Trent for Central England Electricity Scheme. (April 24th.)

June 22nd. Site works, foundation works, buildings and cable bridge at Stockport and Bolton for the North-West England and North Wales Electricity Scheme. (See this issue.)

HAMMERSMITH.—Borough Council. Wiring for heating, cooking and water-heating in flats on Southern housing estate. (See this issue.)

OFFICE OF WORKS.—June 2nd. Electrical accessories. (See this issue.)

Newcastle-under-Lyme. — June 2nd. Electricity Supply Department. Transformers, switch cubicles, metering equipment, &c. (May 8th.)

North-West Midlands.—Joint Electricity Authority. Steam raising fuel, painting work, &c. (May 15th.)

Nottingham.—June 9th. Electricity Department. General stores. (See this issue.)

South Africa.—Johannesburg.—June 15th. Railways and Harbours. Oil engines, pump, compressors, &c., for Usakos Workshop. (G.X. 10368.)*

June 29th. Two electrically-driven traversers and eight trailers. (G.X. 10416.)*

Uruguay.—Montevideo.—June 18th. State Electricity Works. Electrical accessories, including fuse wire, porcelain insulators and supports, lever switches, rotary switches, cut-outs, plugs and sockets, seamless steel conduit, ebonite tubing and lampholders. (A.X. 10908.)*

Warrington.—June 1st. Electricity Department. E.h.p. substation switchgear. (See this issue.)

Watford.—June 18th. Corporation. Electrical heating plant for swimming and slipper baths. (See this issue.)

West Midlands.—June 1st. Joint Electricity Authority. Substation transformers. (May 15th.)

June 10th. Cable work for Ironbridge generating station. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bexhill-on-Sea.—Electricity Committee. Recommended:—
Overhead line from Sidley to Lunsford Cross (£779).—W. T. Glover & Co., Ltd.
H.p. switchgear (£188).—A. Reyrolle & Co., Ltd.
200-kVA transformer (£117).—Crompton Parkinson, Ltd.
Distribution board (£47).—Switchgear & Cowans, Ltd.

Croydon.—Electricity Committee. Accepted:—
Switch-house extension (£6,665).—F. Liley & Son.

Dartford.—Electricity Committee. Recommended:—
L.p. fuse gear at Princes Road sub-station (£47), and at St. Vincent's Road sub-station (£98), and six-way feeder pillar (£45).—Johnson & Phillips, Ltd.

Dewsbury.—Town Council. Accepted:—
Electrical wiring and fittings at old infirmary buildings (£556).—Beaumont & Blackburn.

Ealing.—Education Committee. Accepted:—
Electrical installation at Bordeston School, Hanwell.—Alpha Manufacturing & Electrical Co., Ltd.

Eastbourne.—Electricity Committee. Recommended:—
Kiosks, transformers and switchgear for supply to Hailsham (£1,872).—Crompton Parkinson, Ltd.
Completion of Ashford-Langney ring main (£3,201).—Pirelli-General Cable Works, Ltd.
Switchgear (£758).—General Electric Co., Ltd.

Glasgow.—Electricity Committee. Accepted:—
Plant and appliances in connection with change of frequency:—
Motors (£994).—Metropolitan-Vickers Electrical Co., Ltd.
Spares for rotaries and motors (£234).—Electric Construction Co., Ltd.
6,500-V switchgear (£1,053).—A. Reyrolle & Co., Ltd.
Reconditioning meters.—Metropolitan-Vickers Electrical Co., Ltd.; Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; Chamberlain & Hookham, Ltd.
Lighting Committee. Recommended:—
Steel poles:—Stewarts & Lloyds, Ltd.
Bracket fittings.—British Mannesmann, Ltd.
Transport Committee. Accepted:—
Special track-work.—Edgar Allen & Co., Ltd.; Hadfields, Ltd.
M.s. cable groove rings for subway.—Fullarton, Hodgart and Barclay, Ltd.
Police Committee. Accepted:—
Installation of a passenger lift at new police headquarters (£650).—Glasgow Engineers, Ltd.
Property Committee. Recommended:—
Twelve months' supply of electric lamps in Curator's Department.—J. T. Cartwright & Sons.

Gravesend.—Electricity Committee. Recommended:—
Boiler economiser and automatic stoker (£12,983).—Babcock and Wilcox, Ltd.

Great Western Railway.—Accepted:—
Electric one-ton friction hoist at Hockley.—Brook and Crowther, Ltd.
One-ton electric jib crane at Merthyr.—Holt & Willetts.
Two electrically-driven air compressors at Swindon.—Hellis and Morcom, Ltd.
Twelve months' supply of lamps.—Siemens Electric Lamps and Supplies, Ltd.; British Thomson-Houston Co., Ltd.: Metropolitan-Vickers Electrical Co., Ltd.

Ilford.—Electricity Committee. Recommended:—
500-kW rectifier plant (£2,655).—Whipp & Bourne, Ltd.
L.p. feeder board (£250).—Crompton Parkinson, Ltd.
Truck-type cubicle (£188).—General Electric Co., Ltd.

Japan.—Okura Company. Accepted:—
Electro-magnetic crack detector.—Equipment & Engineering Co., Ltd.

London.—ISLINGTON.—Cleansing Committee. Recommended:—
Four new bodies for electric vehicles (£90 each).—Electricars, Ltd.
Electricity Committee. Recommended:—
Transformers.—Hackbridge Electric Construction Co., Ltd.
ST. PANCRAS.—Contracts and Stores Committee. Recommended:—
Cables.—Hackbridge Cable Co., Ltd. (£4,460); Croydon Cable Works (£4,275).
HACKNEY.—Electricity Committee. Recommended:—
Automatic combustion control scheme (£8,712).—George Kent, Ltd.
Sub-station extensions with e.h.p. and l.p. cable work (£10,389).—Hammond & Barr, Ltd.
L.C.C.—Central Public Health Committee. Accepted:—
Wiring and fittings at pathological laboratories (£374).—Buchanan & Curwen.
Wiring and fittings at St. Leonard's Hospital, Shoreditch (£398).—J. Briggs Electrical Contractors, Ltd.
HAMMERSMITH.—Electricity Committee. Recommended:—
Master frequency meter (£75).—Everett, Edgcumbe & Co., Ltd.
Cable (£2,721).—Standard Telephones & Cables, Ltd.
Transformer kiosk (£103).—W. Lucy & Co., Ltd.
Two Scott-connected banks of transformers (£1,772).—British Electric Transformer Co., Ltd.
ST. MARYLEBONE.—Electricity Supply Committee. Recommended:—
Switchgear and accessories (£3,608).—Ferguson, Pailin, Ltd.
Cables for year ending May 31st, 1932 (extension of contracts).—Enfield Cable Works, Ltd.; British Insulated Cables, Ltd.
BATTERSEA.—Electricity Committee. Accepted:—
2,000-kW motor generator and switchgear (£4,748).—General Electric Co., Ltd.
Switchgear (£345).—Park Royal Engineering Co., Ltd.
WOOLWICH.—Town Council. Accepted:—
Switchboard for Powis Street sub-station (£2,062).—Johnson and Phillips, Ltd.

Manchester. —Education Committee.
Electrical installation at the Harpurhey Special School and Domestic Centre.—A. London; R. Seddon & Sons.
Electricity Committee. Accepted:—
Laying of two cables.—Callender's Cable & Construction Co., Ltd.

South Shields.—Electricity Committee. Accepted:—
Repairs to battery at electricity works.—Tudor Accumulator Co., Ltd.

Truro.—Sewerage Committee. Accepted:—
Motors, pumps and automatic electrical equipment (£1,647).—Pulsometer Engineering Co., Ltd.

Tynemouth.—Health Committee. Accepted:—
X-ray apparatus (£629).—Newton & Wright, Ltd.

Warwick.—County Council. Accepted:—
Installation of internal automatic telephone system at county offices (£1,209).—Reliance Telephone Co., Ltd., in conjunction with the General Electric Co., Ltd.

Watford.—Electricity Committee. Recommended:—
Erection of sub-station at Bedmond (£225).—W. King and Sons, Ltd.
Boiler stoker (£2,000).—Underfeed Stoker Co., Ltd.
Switchgear for Ridge Lane sub-station (£498).—J. S. Plumtree.
Switchgear for Cassion and Oxhey sub-stations (£461).—Metropolitan-Vickers Electrical Co., Ltd.

Whitby.—Urban District Council. Accepted:—
Switchgear for the power station.—A. Reyrolle & Co., Ltd.

Worcestershire.—Education Committee. Accepted:—
Electric lighting at Wollescote school (£120).—T. R. Priest, Blackheath.

Forthcoming Events

Institution of Electrical Engineers.—LONDON STUDENTS' SECTION.—Friday, May 22nd. Institution, London. 6.15 p.m. Annual general meeting.

Association of Mining Electrical Engineers.—Saturday, May 23rd. South Wales Institute of Engineers, Cardiff. 5.30 p.m. Annual meeting. June 12th. Alexandra Rooms, Royal Hotel, Cardiff. 6 p.m. Annual dinner.

Tramways, Light Railways and Transport Association.—May 27th-29th. Margate. Annual Congress.

Scottish Tramways and Transport Association.—May 29th-30th. Taymouth Castle Hotel, Aberfeldy. Ninth Conference.

Notes

An Electric Thresher

A demonstration of a modern threshing mill was given recently at Dalneigh farm, near Inverness. The plant is driven by electricity supplied by Inverness Corporation and the proprietor, Mr. John Fraser, was congratulated on his enterprise. Ex-Bailie Donald Macdonald, Convener of the Inverness Corporation Electricity Committee, expressed the hope that other farmers would in a similar way take advantage of the town's electricity when the area of supply was extended. The mill is made by R. G. Garvie & Sons, and is belt-driven by a 28-h.p. electric motor made by Messrs. Mather & Platt. As the straw leaves the shakers of the mill, travelling haiks fixed to chains pick it up and carry it a distance of about 25 yards. The finished grain is elevated to the roof of the building, where it is delivered to a conveyor. The chaff is blown by means of a wind-blast through piping directly into the fold. By simply pressing a button, the man who is feeding the machine can stop the whole plant. The mill was installed by Messrs. James Ferries & Co., who have established similar plant elsewhere. Mr. Ferries has been responsible for several hydro-electric installations in the Highlands.

Cardano Water-power Plant

We have been requested by the Anglo-Swiss Electrical Co., Ltd., to state that Trüb, Taüber & Co. supplied six complete sets of a.c. temperature-measuring equipment for the generators installed in the above-named station to which reference is made in our May 15th issue. The equipment, in conjunction with protection transformers, measures the actual copper temperature of the windings besides those of the stator iron, oil, and bearings. The company also supplied a number of 220,000-volt resistance potential transformers.

New "Osram" Photo Cell

The General Electric Co., Ltd., has produced a gasfilled photo cell of the caesium C.M.G.8 type, which permits the application of higher voltages and therefore has greater emission without any appreciable limitation of frequency response. The minimum sensitivity is about 75 microamperes per lumen, but in the case of many of the cells this figure is greatly exceeded. Its frequency-response curve is of importance in showing to what extent the cell will reproduce the higher frequencies of the musical scale and as an indication of its suitability for use in sound-film projectors; the loss is only about 1.5 decimel at a frequency of 8,000, which is better than that of a potassium cell. The improved cell incorporates such advantages of its predecessor as great sensitivity to white light and infra-red rays; a standard valve base to the anode pin of which the cell anode is connected, together with the addition of a very long insulation resistance path between the electrodes, ensuring freedom from parasitic noises and giving a long useful life. The recommended working voltage for general purposes, marked on the cell, is about two thirds of the sparking voltage.

Water Power in Italy

The Coghinas hydro-electric power station recently completed on the Italian island of Sardinia by the Società Elettrica Sarda is interesting in that, to avoid the construction of a water tunnel working under pressure, the plant has been located underground. By means of a 180-ft. dam across the River Coghinas, a triangularly-shaped lake with a storage capacity of about 55,000 million gallons of water has been formed, the maximum and normal heights above sea level being 537 and 446 ft., respectively. The water falls under pressure down an absolutely vertical pipe to 216 ft. above sea level and thence into a canal 2½ miles in length. The plant in the underground station comprises four turbines, two of which are each coupled to two 3,000-kW d.c. dynamos and a 3,000-kVA alternator, while the other two are each connected to 7,500-kVA alternators. The four turbines are of identical design and capacity. Of the Francis horizontal-shaft type, they are designed to develop 8,000 kVA at 500 r.p.m. under a head varying between 295 and 344 ft. The plant is unique in that it practically forms two power stations in one, direct current being supplied to a neighbouring ammonia producing works and alternating current for general lighting and power purposes on the island, a transforming station stepping the voltage up to 75,000 V for transmission purposes.

Joint Electricity Authorities

There are four Joint Electricity Authorities at present in existence; their constitutions are similar but they operate in different ways.

The North Wales and South Cheshire Joint Electricity Authority operates entirely through the North Wales Power Co., Ltd. The West Midlands and North-West Midlands Joint Authorities have taken over the public supply generating stations in their areas and from them they supply in bulk for the distribution areas of the former owners.

We give below a brief outline of the work of the London and Home Counties Joint Electricity Authority, which indicates that that body is quietly and steadily carrying out its statutory obligation "to provide or secure the provision of a cheap and abundant supply of electricity." This Authority has not only made arrangements, in conjunction with the Central Board, for bulk supply to many undertakings not being owners of selected stations, but also exercised the purchase rights of a number of local authorities, thereby consolidating several undertakings into one and preventing their being divided up into a greater number of small distribution areas. The London Joint Authority thus become the actual distributors in one continuous area, covering approximately 120 square miles, and stretching from Twickenham in the north to Dorking in the south.

The Authority has in its programme of consolidation not only made substantial reductions in the charges hitherto in force in these areas, but has also introduced uniform two-part tariffs throughout the area for domestic and business premises and power purposes, in conformity with the report of the Electricity Commissioners' Committee on "Tariffs." Likewise uniform and reduced meter rents, service charges, &c., have been brought into force; an assisted wiring scheme and the hire of apparatus, together with arrangements for street lighting will result in very substantial development of the distribution systems. A note on the propaganda of the Authority will be found on p. 875. Thus a great step forward has been taken in the consolidation of distribution areas under one publicly controlled central body.

In regard to bulk supplies, agreement has been reached by the London Authority with the owners of the undertakings at Finchley, Hornsey, Islington, Hammersmith, Barnes, Woking, Epsom, Reigate, and Walton, and others are under consideration. Where generating stations are in existence, arrangements under the Authority's special powers have been made for the continued operation of these stations in the most economical way in conjunction with the "grid" in a similar manner to selected stations. By this means undesirable extensions of non-selected stations have been prevented, but at the same time undesirable scrapping of useful plant is avoided, all future requirements amply provided for, and—what is most important of all—the cost, as provided for in the 1926 Act, will be less than under independent operation, and evidence of this is seen in the fact that four of the undertakings have reduced their charges to the public following the coming into operation of "bulk supply."

In addition to the above, the London Authority have other special duties peculiar to their district arising out of the fact that the whole of the property of the Companies in the "London area" is to come under the ownership and control of the Authority in 1971, the one of most concern to the consumers being the re-fixation of standard prices when the reduced rates of dividend become operative next year.

The Electrical Association for Women

To the East Devon branch of the Association on May 13th Dr. J. A. Purves, consulting electrical engineer, explained an invention of his resulting from research in spherical locomotion, and showed a film of his invention in action. The means of locomotion took the form of a passenger seat running on a circular track inside a partial sphere. The passengers' weight served to keep the seat at the bottom of the sphere. No springs or tires were necessary, and Dr. Purves declared that he knew of no mechanism which was so efficient. He had worked his machine with a 2½-h.p. motor-cycle engine, and had been able to take a gradient of one in nine. Speaking on water power, he said he was perfectly certain that the day was not far distant when, for economic reasons, we would make use of every ounce of water obtainable. Water-power undertakings depended primarily on the rainfall of the district and the altitude upon which the rain fell, and there could be no doubt that Dartmoor was quite remarkable as a potential source of power.

The Glasgow and District Branch of the Association held a

cake and candy sale on May 7th to raise funds in connection with the coming conference in that city. Miss Mary Mackirdy, branch vice-president, in introducing Mrs. McCredie, daughter of Lord Provost Kelly, who opened the sale, said she thought the term housework might now be superseded by "household science." Mrs. McCredie, honorary vice-president, said that one of the main objects of the Association was to instruct the members by means of lectures and demonstrations how to use various electrical appliances so as to derive the best results from them.

Appointments Vacant

Assistant lecturer in electrical engineering at Bristol University.

Switch-room engineers for Croydon Electricity Department. (See our advertisement pages to-day.)

Coal Bunkering at Glasgow

The Mitchell Conveyor Company is the designer of an all-electric coal conveyor which is nearing completion at the general terminus quay, Glasgow. Built for the railway companies' coal-loading trade there, the conveyor will supersede four steam cranes. Wagons will be run on to a weighing machine and the platform will lift the wagons and tip the coal into a conveyor belt, which carries it up over the roadway to the "chute" at the quayside. Perched on top of the "chute" is the controller's cabin. The "chute" has a radius of about 40 ft., with a movable "mouthpiece" so that the coal may be directed to any part of a ship's hold.

Cathode Spot in Mercury

The following information regarding the fraction of the current at the cathode of a mercury arc which is carried by electrons is reproduced in *Nature*. They show that the temperature of the cathode spot is so low that the electron emission cannot be of thermionic origin. The results therefore are in support of Langmuir's theory, according to which the electron current from the cathode is a field current of electrons which are drawn out by the intense field concentrated there by the positive ion space charge. Four years ago Dr. Van Voorhis and Mr. Karl T. Compton presented to the National Academy of Sciences, U.S.A., a theory of the heat balance at the cathode. This theory is now extended by evaluating factors regarding which there was then insufficient knowledge. There are eight principal ways in which heat is fed into or taken away from the cathode. All these are now evaluated except for uncertainty in two quantities, one being the fraction of positive ions produced near the cathode which move, contrary to the applied voltage, toward the anode, and the other is the accommodation coefficient which measures the fraction of kinetic energy of a positive ion impinging on the cathode, which is delivered to the cathode. Certain experimental evidence regarding these unknown quantities leads to the conclusion that the fraction of current carried by electrons at the cathode is certainly considerably in excess of 0.80. By applying equations of kinetic theory of gases to the observed rate of evaporation of mercury from the cathode spot, an equation relating vapour pressure to temperature at the surface of the cathode spot is obtained. By comparing this equation with the ordinary vapour pressure temperature relation for mercury vapour, unique values are found for the temperature of the cathode spot and the vapour pressure immediately outside it. These values depend on the value of the fraction of current carried by electrons, but the permissible values of this fraction show that the temperature of the cathode spot cannot be higher than about 200 deg. Centigrade. A consideration of the mechanism of ionisation and of the pulling of electrons out of metals indicates that the ionisation near the cathode must be of the cumulative type in which an atom is ionised by successive impacts of at least two electrons. A potential distribution curve can be plotted for the region near the cathode which appears to be constant with all known facts regarding the mercury arc. This theory appears to be equally applicable to the small mercury arc, such as that used for illumination and for the very large arcs now used in the metal tank rectifiers for electric railway operation.

I.E.E. Scottish Excursion

The joint meeting of the Scottish Centre and Sub-Centre at Dundee was held on Friday and Saturday, May 8th and 9th. Members and friends visited the transatlantic wireless telephony receiving station at Cupar, Fife, and in the evening the Faraday lecture on "The Birth of Electrical Engineering" was delivered by Prof. W. Cramp; the meeting was open to the public and there was an appreciative audience of about 700. On the Saturday there was an excursion by road to Braemar, *via* the Spittal of Glenshee, returning *via* Glenisla, which was taken part in by about 75 members and friends, including ladies, and was greatly enjoyed by all under the favourable weather conditions prevailing.

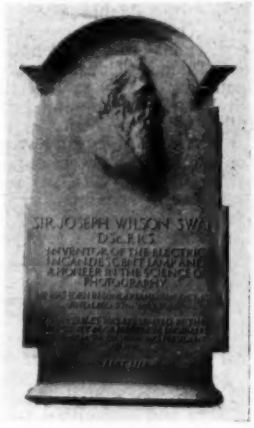
Japanese 1,500-Volt Automatic Sub-stations

The Ise Electric Railway is one of the rapidly developing private transport systems in Japan. When completed, its double-track 3 ft. 6 in.-gauge line will extend from Nagoya to Yamada, a distance of 68 route miles. Electricity is furnished by the Toho Power Co., is transmitted by a three-phase overhead line at 11,000 volts, 60 cycles, and is converted to 1,500 V, d.c., at three automatic sub-stations, the equipment for which was supplied by the English Electric Co., Ltd. Conversion is carried out in each by two pairs of series-connected rotary-convertors having a total capacity of 4,000 kW. The machines are arranged for tap starting, each is fitted with a directly-coupled exciter, overspeed and no-start devices, and bearing thermostats. Control apparatus is compactly grouped, a feature being a semi-circular desk from which the equipment may be controlled by push button, if desired.

Normally, the first set is started by a master time switch, which gives an impulse to the oil circuit-breaker closing relay. Shutting down is effected by the master time switch and the sequence of starting up is pre-determined by switches on the control desk. The machines are fully protected against faults. If troubles occur the set or feeder concerned is locked out and the protective devices must be re-set by hand when normal conditions are restored.

The Swan Memorial

On Friday, June 5th, Mr. Clifford C. Paterson, O.B.E., president of the Institution of Electrical Engineers, will unveil a plaque in the entrance hall of the Sunderland Central Library, Museum and Art Gallery, in memory of Sir Joseph Wilson Swan, D.Sc., F.R.S., inventor of the first practical incandescent electric lamp and a pioneer in the science of photography.



The plaque will be presented to the Borough of Sunderland, the town of Swan's birth, by the Institution.

The Institution of Electrical Engineers and a number of prominent citizens of Sunderland have formed a committee with the object of founding Swan Memorial Scholarships in Electrical Science, as stated in the ELECTRICAL REVIEW of February 27th, 1931 (pp. 362 and 386).

The hon. secretary of the fund is Mr. Stanley Pfob, 118, Sorley Street, Sunderland, who, on application, would be pleased to forward further particulars.

Donations should be sent to Mr. E. T. Nicholson, Martin's Bank, Fawcett Street, Sunderland, or to Mr. P. F. Rowell, secretary, the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2. Each donation will be individually acknowledged.

Non-magnetic Materials

In the construction of electrical machinery and apparatus where an alternating or rotating flux is present, it is necessary in order to prevent hysteresis losses to use non-magnetic materials, such as brass, gunmetal, or aluminium. These materials are relatively expensive and, moreover, being good conductors of electricity they are consequently susceptible to eddy currents with their attendant heat losses. In the design of switchgear where a conductor carrying more than 800 amps. passes through a metal plate, insulator clamping ring, or other similar case in which the conductor is encircled by metal, this metal must be non-magnetic.

The non-magnetic cast iron known under the trade name of "Nomag" has a percentage of nickel added. It has a high electrical resistance, and is tougher than the more usual cast iron. The tensile strength is the same as for ordinary cast iron, being 9 to 11 tons per square inch.

Material.	Magnetic permeability maximum.	Specific resistance microhms per cm. cube.
Ordinary cast iron ...	240	95
Nomag	1.03	150
Brass	1.0	7

While the material is readily machinable, the same tools as would be used for mild steel are advised due to its toughness. The shrinkage for castings is 3/16 inch per foot against ¼ inch for cast iron. Nomag is very suitable for resistance grids due to its high specific resistance compared with ordinary cast iron, the resistance temperature coefficient between the range of 0 and 100 deg. C. being 0.00045, compared with 0.00019 for ordinary castings. The maximum working temperature should not exceed 500 deg. C. to prevent any risk of sagging.

In the cases where a material having better mechanical properties is required, cast steels which are non-magnetic can be obtained; the data given below refer to the products of Edgar Allen & Co.

Name.	Tensile strength. Tons per sq. in.	Yield point. Tons per sq. in.	Specific resistance. Microhms per cm. cube.
Maxilvery ...	40 ...	15 ...	77.5
Maxhete ...	47 ...	17 ...	79.6

The resistance temperature coefficients for the two grades respectively are 0.0011 and 0.00084 per deg. C.—H. E. HUTTER.

High-voltage D.C. Plant

We are informed by Messrs. Ruston & Hornsby, Ltd., that the oil engines which formed part of the generating plant for the B.B.C. regional station at Slaithwaite are of their manufacture.

The oil engines in question were referred to on page 833 of our last issue.

Trolley-'buses in London

THE first trolley-'bus service in London began working on May 16th, 1931, on the Twickenham Junction-Teddington section of the London United Tramways, Ltd. Before the end of the present summer about 17 miles will have been converted to trolley-'bus operation, comprising the whole of the route worked by the L.U.T. in the Kingston, Surbiton, Malden, and Wimbledon areas, and the Teddington-Hampton Wick section of the Hampton Court loop, which is linked with the Surrey routes by a line over Kingston bridge. At Wimbledon and Kingston certain short lengths of route (dead-ends) will lapse from service. A good deal of the tramway track on the lines in question is approaching the renewal stage, and new rolling stock is also required; traffic is not very dense, and the Underground Company, which controls the L.U.T., decided that conversion was an advantageous proposition.

To ensure steady line voltage an automatic mercury-vapour sub-station is being installed at Malden; as the trolley-'buses, although nominally of 80 h.p., develop 150 h.p. at starting, the celerity with which they can get away from stopping-points thus hinges on equable pressure. They are double-saloon 56-seaters, similar to the L.T. type of L.G.O.C. motor-'bus; sixty are being built, and the traction equipment is by the English Electric Co. and the British Thomson-Houston Co., the former supplying the equipment for 35 'buses and the latter for the remaining 25. Each 'bus has a dipping head lamp, weighs 11 tons 16¼ cwt. fully loaded, is 27 ft. 7½ in. long, 7 ft. 5½ in. wide, and about 14 ft. 4 in. high, having a fully-loaded speed of 29.4 m.p.h. on the level and of 18 m.p.h. on a 5 per cent. gradient. Acceleration is up to 3 ft. per sec. per sec., which permits 20 m.p.h. to be attained in 10 seconds within a distance of 62 yards. Deceleration can be effected at 8 ft. per sec. per sec., and at 12 ft. per sec. per sec. in emergency to enable a 'bus running at 30 m.p.h. to be brought to a standstill in about 80 ft. The average scheduled speed, including stops, is from 10 to 12 m.p.h.

Tubular propeller-shafts and with Spicer couplings take the drive from the motor to the rear axles through self-aligning ball bearings. With the exception of the resistances, the whole of the single-motor equipment is mounted at the front of the vehicle. The box-frame self-ventilating motors are of the DK.-130 and the 110-DL types, with normal ratings of 80 and 82 h.p., mounted on roller bearings and can be lifted out through the front of the bonnet. The contactor gear master controller is foot-pedal operated and the reverser by hand. Besides the two overhead collector booms, a skate attached to the chassis, operated by an interlocked change-over switch, enables a trolley-'bus to be manœuvred on tramway tracks where there is no overhead return wire. Internal expanding brakes are fitted to all six wheels and applied by pedal operation, amplified by the Dewrandre servo-vacuum system, with a Reavell rotary exhauster actuated by an electric motor mounted together on top of the traction motor. With the rheostatic brake speed can be reduced from 20 to about 8 m.p.h.

The lower saloon accommodates 24 passengers and has four lateral seats on each side of the forward part of the gangway, one longitudinal seat under the staircase, and another facing the staircase. In the upper saloon are seats for 32 passengers, eight lateral two-person seats on the "near" side," five on the "off," and a six-person seat across the rear end. The London United Tramways, Ltd., introduced the electric tramcar to London on April 4th, 1901, and it is not inappropriate that the railless trolley-'bus should be introduced on the same system.

I.E.E. Western Centre Summer Meeting

THE annual summer meeting of the Western Centre of the Institution of Electrical Engineers was held at Plymouth last week-end, the attendance numbering about 80. The proceedings opened with the annual general meeting at which the following officers and committee were elected. Chairman: Mr. J. Wayne Morgan; vice-chairmen: Messrs. F. H. Conson and A. Nichols Moore; committee (five vacancies): Messrs. H. Manley Roberts, E. Douglas Coe, J. W. Beauchamp, A. J. Newman, and R. A. Parsons.

A dance was held at the Grand Hotel, which was the headquarters of the visit. Saturday was occupied with a charabanc tour of about ninety miles over Dartmoor to Buckfast Abbey and Totnes, then by steamer down the River Dart to Dartmouth where the coaches were rejoined. The party reached Plymouth about 7 p.m. after a most enjoyable tour, despite bad weather in the afternoon.

In the evening a dinner, presided over by Mr. E. G. Okell, chairman of the centre, was held. The toast of "Our Guests" was proposed by Major J. Wayne Morgan, chairman-elect, and responded to by the Mayor of Plymouth (Mr. J. Clifford Tozer). The toast of the "Institution of Electrical Engineers" was proposed by Alderman Modley, chairman of the Electricity Committee, Plymouth, to which Mr. Okell responded.

On Sunday morning a steamer trip around Plymouth Sound and the adjoining rivers was arranged, and on the Monday morning there were visits to Mount Batten air station and the marine biological laboratory.

The accompanying photographs, for which we are indebted to Mr. S. F. Philpott, show groups at Buckfast Abbey and on the steamer in Plymouth Sound, while the top right-hand group includes Messrs. Beasant (hon. secretary, Western Centre), Okell (chairman), Williams, Hodge, and Newman.

On the Sunday afternoon the golf cup presented annually by the past-chairman of the Centre was played for, mixed foursome stroke competition, on the picturesque Bigbury-on-Sea links, which were loaned for the afternoon by Mr. A. J. Nettlefold. It was won by Mr. E. E. M. Smith, a student member of Torquay, who was partnered by Mrs. Coope of Cardiff. After tea at the club house a visit was paid to Burgh Island and hotel by invitation of Mr. W. Cunliffe.

The committee responsible for the arrangements was Messrs. E. G. Okell (chairman), Dr. Archibald, H. F. Hunt, D. Curd, C. Culmer Hodges, S. G. Monk, R. Illingworth, and F. G. Jones (secretary).

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

The Irish Free State Press reports that **Dr. T. A. McLaughlin,** the managing director of the Free State Electricity Supply Board, and **Mr. J. J. Murphy,** a director of the Board, have resigned their positions. It is apparently not proposed to appoint a new managing director. Dr. McLaughlin, who was connected with the Siemens-Schuckertwerke, Berlin, was the moving spirit in the Shannon scheme. He gives as the reason for his resignation differences of opinion on matters of major policy between himself and the Executive Council. Dr. McLaughlin's term of office should have continued for a further fifteen months. Mr. Murphy, who was a part-time member of the Board, was appointed last year for a five-year period. The Board will now comprise Messrs. R. F. Browne (chairman) and Mr. J. F. Foy, M.Sc., as full-time members, and Dr. J. C. Foley, Dr. H. Kennedy, and Mr. P. J. Egan as part-time members.

In our last issue we recorded the registration of the Midland Electric Installation Co., Ltd. This represented the conversion of the firm known as the Midland Electric Power Installation Co., the members of which were **Mr. Henry Joseph,** who was for many years with Edmundsons' Electricity Corporation, and **Mr. J. M. Hollander,** formerly on the contract staff of British Insulated Cables, Ltd. They are now directors of the new company.

The Council of the Institution of Electrical Engineers has made the following awards of premiums for papers read during the 1930-31 session, or accepted for publication:—The Institution premium to Commendatore G. Bianchi. Ayrton premium to Mr. R. Grierson. John Hopkinson premium to Messrs. J. W. Rissik and H. Rissik. Kelvin premium to Messrs. B. L. Goodlet, F. S. Edwards, and F. R. Perry. Paris premium to Mr. P. J. Ryle. Extra premiums to Mr. W. E. M. Ayres; Mr. R. M. Charley; Mr. H. S. Carnegie; Mr. D. B. Hoseason; Dr. J. J. Rudra and Prof. Miles Walker; Prof. W. Cramp and Mr. A. P. Jarvis; Mr. P. J. Higgs, Messrs. J. C. Prescott and E. W. Connon; Messrs. G. G. Smail, R. J. Brooksbank, and Prof. W. M. Thornton; Prof. S. P. Smith; Prof. E. Wilson. *Wireless Section Premiums.*—Duddell premium to Mr. T. Walmsley. Extra premiums to Mr. C. E. Horton and Mr. C. E. Rickard. *Meter and Instrument Section Premiums.*—Silvanus Thompson premium to Prof. W. M. Thornton, Messrs. M. Waters, and W. G. Thompson. Extra premium to Messrs. E. W. Hill and G. F. Shotter.

We congratulate **Miss Gladys F. Sharp,** a member of the E.A.W. Executive Committee, on having her third novel, "The Cage," published recently by Eveleigh Nash & Grayson, Ltd.

Col. R. E. B. Crompton celebrates his diamond wedding on June 6th and at last week's I.E.E. meeting it was resolved to send the Institution's congratulations to him and Mrs. Crompton.

Mr. J. R. Bird, engineer-in-charge of the Manchester station of the B.B.C., has been appointed to the control of the new Scottish regional station. He is succeeded at Manchester by **Mr. L. Harvey,** who has occupied posts at the Newcastle, London and Leeds stations.

Lafayette [*London.*

Mr. J. Cecil Bull,

Who has served the City of London Company for 40 years.

Mr. J. Cecil Bull, whose portrait appears on the left, was entertained to luncheon on May 13th by the staff of the City of London Electric Lighting Co., Ltd., to mark his completion of 40 years' service with the company, and as a memento of the occasion he was presented with a cabinet of cutlery. Mr. Bull joined the company as secretary upon its inception in 1891; he subsequently became manager and secretary, and for the past 25 years has been one of the joint managing directors. Mr. A. F. Harrison, the present secretary of the City Company, presided at the luncheon and made the presentation. He eulogised Mr. Bull's long service in the organisation and management of the company. Mr. Bull expressed his appreciation of the gift and the kindly sentiments which prompted it. He said that he would preserve it as visible evidence of the goodwill which he was proud and gratified to have inspired.

On Friday last week, the marriage took place at Watford of Mr. F. G. Brown and Miss Paterson, daughter of **Mr. C. C. Paterson,** President of the Institution of Electrical Engineers. A reception was subsequently held at Waldringfield, the guests including Sir Hugo Hirst, Bt., and Lady Hirst, Col. Sir Thomas Purves, engineer-in-chief of the G.P.O., and Lady Purves, Sir Archibald and Lady Page, Dr. and Mrs. A. Russell, Dr. and Mrs. Eccles, Mr. and Mrs. Railing, and Sir Robert and Lady Robertson.

Mr. R. Alan Thwaites, B.Sc. (Eng.), who has been elected chairman of the Yorkshire Centre of the Institution of Civil Engineers for the ensuing session, is leaving England next month for a tour of Western and Central Europe. Mr. Thwaites has contributed several technical articles to this journal; he is 42 years of age and he has served on the Yorkshire Committees of both the Institutions of Mechanical and Electrical Engineers. He is associated with the Yorkshire Electric Power Company, under the general manager, Mr. W. B. Woodhouse. Mr. Thwaites was formerly with Messrs. W. H. Allen, Sons and Co., Ltd., at Bedford.

Mr. R. Alan Thwaites,

Chairman of the Yorkshire Centre of the Institution of Civil Engineers.

Mr. J. W. Watters, is retiring on superannuation from his position with the Ipswich Electricity Department after 21 years service. He was recently presented by the staff with a wallet of Treasury notes.

Mr. R. A. Chattock, until recently city electrical engineer of Birmingham, is to receive the honorary M.Sc. degree at the annual degree ceremony of the University of Birmingham on July 4th.

Mr. H. Marryat has commissioned Mr. David Jagger to paint a portrait of the late Dr. S. Z. de Ferranti, which is to be hung in the lecture theatre of the Institution of Electrical Engineers.

Mr. H. Tetlow, electrical engineer to the Bacup Town Council, has resigned that position.

Obituary

Sir A. Trevor Dawson.—We regret to report the death of Commander Sir Arthur Trevor Dawson, Bt., which occurred suddenly this week at Elstree. Sir Trevor Dawson, who was 65 years of age, joined the Navy in 1879 and was later engaged in special ordnance work for the Admiralty. He resigned from the Navy in 1896 to become superintendent of ordnance to Vickers, Sons & Maxim, Ltd. He continued with the Vickers companies until the end. He was a director of Vickers-Armstrongs, Ltd., and chairman or director of several allied concerns.

M. J. T. Blondin.—We learn with regret from Paris of the recent death, at the age of 68 years, of M. Joseph Theophile Blondin, the director and founder of our French contemporary *La Revue Générale de l'Electricité.* The deceased was a member of the Comité Electrotechnique Français, the Comité Français de l'Eclairage et du Chauffage, and many other bodies.

Mr. R. T. Wolfe.—The death occurred on May 11th, at the age of 70, of Mr. Richard T. Wolfe, consultant to Cables and Wireless, Ltd.

Wills.—The late **Mr. Frederick King,** principal of Messrs. King & Co., electrical engineers, Bristol, left estate valued at £8,070 gross (£4,133 net personalty).

We recently reported that the late **Sir Charles A. Parsons** left estate valued at £810,395, with £602,434 net personalty. Last week particulars of a number of bequests were published showing that Sir Charles left shares in the companies with which he was associated to a number of employés.

The late **Mr. Henry Pilling,** a director of Galloways, Ltd., and president of the Manchester District Engineering Employers' Association, left estate valued at £20,714 gross and £19,262 net.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Meloto Company, Ltd.—Private company. Registered May 15th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in gramophones and musical instruments of all kinds, television, electrical and wireless apparatus and accessories, &c. The subscribers (each with one share) are: E. J. Yorke, 4, Devonshire Road, Newbury Park, Essex (solicitor's clerk), and J. C. Cox, Lloyds Buildings, E.C.3 (solicitor). The first directors are to be appointed by the subscribers. Registered office: 85, Berwick Street, W.

Howard Smith (Electrical Engineers), Ltd.—Private company. Registered May 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical and mechanical, consulting and civil engineers, manufacturers of and dealers in electrical, magnetic, telegraphic, telephonic, wireless and other appliances, &c. The directors are: Mrs. N. Smith, 243, Stanstead Road, Forest Hill, S.E.23, and P. Durrant, 34, Buller Road, Thornton Heath (electrical engineer). Solicitors: Crosse & Sons, 38, Bedford Square, W.C.1.

Meikle & Philip, Ltd.—Private company. Registered in Edinburgh on May 7th. Capital, £1,500 in £1 shares. Objects: To carry on the business of heating, ventilating, electric, hydraulic, pneumatic, water, domestic and general engineers, &c. The subscribers (each with one share) are: J. Philp, 26, Bonaly Road, Edinburgh, heating engineer; W. W. Reid, 14, Court Street, Haddington, surveyor, and J. S. Dunbar, 5, Chancelot Terrace, Edinburgh, certified accountant. The first directors are not named. Registered office: 2, North Junction Street, Leith.

Bela Radio, Ltd.—Private company. Registered May 6th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in instruments, accessories and materials used in connection with radio telegraphy, telephony, television, and gramophones and radio gramophones, electricians, &c. The first directors are: A. H. Spalton, 14, Dalewood Drive, Sheffield; and A. Craddock, 68, Bowfield Road, Firth Park, Sheffield (both directors of Spalton Electrical Stores, Ltd.). Registered office: 18, Cadman Lane, Sheffield.

Dielectrics, Ltd.—Private company. Registered May 11th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in insulating products and materials, mica and other similar products or substances, &c. The life directors are: M. D. Ray, 5, Priory Road, Kew Green, Richmond, mica merchant (chairman); and R. Vayda, 17, Hillsboro Road, East Dulwich, S.W.22, mica merchant. Registered office: 97, Queen Victoria Street, E.C.4.

Multitone Electric Co., Ltd.—Private company. Registered May 9th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with J. Poliakoff, to manufacture and turn to account various articles which are the subject-matter of the letters patent and other inventions mentioned in the said agreement, and to carry on the business of electricians, radio and electrical engineers, experts and contractors, mechanical engineers, &c. The directors are: J. Poliakoff, 14, Sutcliffe Close, Hampstead Garden Suburb, N.W.11; and H. D. Myer, 3, Upper Hamilton Terrace, N.W.8. Registered office: 86/88, Queen Victoria Street, E.C.4.

S. T. Pemberton & Co., Ltd.—Private company. Registered May 9th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers for light, heat, motive power or otherwise, manufacturers of and dealers in apparatus for use in connection with schemes of water purification, and also with the generation, distribution, supply, accumulation and employment of electricity, &c. The directors are: S. T. Pemberton, "Norwood," Knowles, Warwickshire (chartered electrical and mechanical engineer) and Mrs. Helen Pemberton, "Norwood," Knowles, Warwickshire. Registered office: 8, Church Street, Birmingham.

British Labour Saving Devices, Ltd.—Private company. Registered May 14th. Capital, £3,000 in 1,000 management and 2,000 ordinary shares of £1. Objects: To carry on the business of manufacturers and retail distributors of household and other appliances of a mechanical, electrical or other nature, &c. The subscribers are: L. J. Healing, Hanmer Lea, Eastbourne (merchant) and W. F. Sparham, Inverness Court Hotel, Inverness Terrace, W. (company director). The first directors are to be appointed by the subscribers. Solicitors: Redden & Booth, 17, Victoria Street, S.W.1.

Faraday Battery and Equipment Co., Ltd.—Private company. Registered May 14th. Capital, £100 in 2s. shares. Objects: To manufacture and deal in accumulators, &c. The subscribers (each with 1 share) are: P. C. Squire (clerk) and F. C. Winter (clerk), both of 3-4, Clements Inn, Strand, W.C.2. The first directors to be elected at the first general meeting. Solicitors: Buckeridge and Braune, 3-4, Clements Inn, W.C.2.

Kelvin Accumulator Co., Ltd.—Private company. Registered May 14th. Capital, £3,000 in 10s. shares. Objects: To manufacture and deal in accumulators, &c. The subscribers (each with one share) are: P. C. Squire (clerk) and F. C. Winter (clerk), both of 3-4, Clements Inn, Strand, W.C.2. The first directors to be elected at the first general meeting. Solicitors: Buckeridge & Braune, 3-4, Clements Inn, W.C.2.

Moldrite, Ltd.—Private company. Registered May 18th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in bakelite and other moulding materials, mechanical and general engineers, &c. The directors are: Isabel A. Massey, 21, Addington Grove, Sydenham, S.E.26; A. M. Lovett, 56, Seward Road, Bromley, Kent; and S. Prentice, Ivyside, Addington Grove, Sydenham, S.E.26. Registered office: Cobbs Court, 24a, Silverdale, Sydenham, S.E.26.

S. & J. Crompton, Ltd.—Private company. Registered May 9th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical and wireless engineers, &c. The directors are: S. L. Crompton (engineer) and Mrs. Frances Crompton, both of 129, High Road, Chiswick, W.4. Registered office: At above address.

General Illuminating Co., Ltd.—Private company. Registered May 16th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical fittings, &c. The first directors are: A. Wilson, 42, Cranwich Road, Stamford Hill, N.16, and N. Friedlander, Strand Palace Hotel, W.C., electrical dealers. Registered office: Empire House, 8, St. Martins le Grand, E.C.1.

P. H. Jackson & Co., Ltd.—Private company. Registered May 16th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical, radio, mechanical and general engineers, engineering contractors, &c. The subscribers (each with one share) are: P. H. Jackson, 174, Corporation Street, Birmingham, engineer, and J. E. Hartles, Alston Buildings, 17, Spiceal Street, Birmingham, accountant. The first directors are to be appointed by the subscribers.

Returns of Electrical Companies

Cleveland & Durham Electric Power, Ltd.—The debentures secured by trust deed dated October 6th, 1913, and a supplemental trust deed dated December 31st, 1918, registered October 23rd, 1913, and January 17th, 1919, respectively, were satisfied on various dates between January 1st, 1931, and March 18th, 1931, to the extent of £52,600, being balance of £159,900 debentures issued, the remainder of the £250,000, authorised by the said deeds, *viz.*, £90,100, never having been issued.

Buckley, Saunders & Co., Ltd. (formerly National Electric Welding Co., Ltd.).—P. Buckley, of Lanford, New Road, Solihull, Birmingham, was appointed receiver on April 28th, 1931, under powers contained in debentures dated May 25th, 1922, and May 28th, 1925.

R. A. Poole (London), Ltd.—Capital, £1,000 in £1 shares. Return dated December 1st, 1930. All shares taken up. £10 paid, £990 considered as paid. Mortgages and charges, nil.

Sifam Electrical Instrument Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 12th, 1931. All shares taken up. £4 paid, £996 considered as paid. Mortgages and charges, nil.

W. D. Willson, Ltd.—Capital, £1,500 in £1 shares. Return dated January 13th, 1931. All shares taken up. £1,500 paid. Mortgages and charges, nil.

Junit Manufacturing Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 24th, 1930. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Dutton Manufacturing Co., Ltd.—F. G. Stone, of 60, Strand, W.C.2, ceased to act as receiver and manager on May 1st, 1931.

British Glass Wool Co., Ltd.—Satisfaction in full on November 26th, 1925, of debenture for £600 dated October 25th, 1922, and registered October 30th, 1922. (Notice filed May 9th, 1931.)

William Griffiths, Sons & Cromwell, Ltd. (in voluntary liquidation).—Mortgage dated April 23rd, 1931, to secure £1,150, owing under equitable charge dated May 1st, 1929. Property charged: "Woodhill," Earle Drive, Parkgate, Ches. Holder: Mrs. L. A. Earle, Beach Priory Gardens, Southport.

Cleartron (1927), Ltd.—D. L. Honeyman, of 9, Basinghall Street, E.C.2, was appointed receiver on April 30th, 1931, under powers contained in debentures dated March 28th, 1929. S. W. Tubbs has ceased to act as receiver and manager.

Full Light Safety Lamps, Ltd. (formerly Full Light Anti-Dazzle Lamp (Parent) Ltd.).—P. Mordant, of 115-117, Cannon Street, E.C., was appointed receiver and manager on April 30th, 1931, under powers contained in debentures dated January 14th, 1930.

Century Lamps (London), Ltd.—Capital, £500 in £1 shares. Return dated November 25th, 1930 (filed April 23rd, 1931). All shares taken up. £500 paid. Mortgages and charges, nil.

Hart Bros. Electrical Mfg. Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 12th, 1930. 4,474 shares taken up. £4,474 paid. Mortgages and charges, £4,500.

Robt. F. Hearn, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1930. 250 shares taken up. £250 paid. Mortgages and charges: £805.

Vulco Dry Battery Co., Ltd.—Capital, £8,000 in 1,500 preference and 6,500 ordinary shares of £1 each. Return dated January 2nd, 1931. All shares taken up. £3,667 paid. £4,333 considered as paid. Mortgages and charges, nil.

Wickford & District Electricity Supply Co., Ltd.—Capital, £10,000 in 8,500 ordinary and 1,500 preference shares of £1 each. Return dated May 14th, 1930 (filed January 2nd, 1931). All shares taken up. £9,995 paid on 8,495 ordinary and all the preference shares. £5 considered as paid on 5 ordinary shares. Mortgages and charges, nil.

Mid-Cheshire Electricity Supply Co., Ltd. (formerly **Northwich Electric Supply Co., Ltd.**).—Satisfaction to the extent of £10,810 on April 1st of mortgage debentures authorised by resolution dated December 5th, 1904, and registered January 28th, 1905.

Reid, McFarlane (London), Ltd.—Capital, £36,000 in 30,000 cumulative preference and 6,000 ordinary shares of £1 each. Return dated January 13th, 1931. 15,000 preference and 3,000 ordinary shares taken up. £18,000 paid. Mortgages and charges, nil.

Electric Zinc Co., Ltd.—Capital, £2,000,000 in 400,000 preference and 1,600,000 ordinary shares of £1 each. Return dated December 30th, 1930. 7 ordinary shares taken up. £7 paid. Mortgages and charges, nil.

Central Electric Supply Co., Ltd.—Capital, £350,000 in £5 shares. Return dated February 24th, 1931. 65,000 shares taken up. £100,000 paid. £225,000 considered as paid. Mortgages and charges: £381,648.

Thrissell Engineering Co., Ltd.—Capital, £150,000 in 5s. shares. Return dated January 13th, 1931. 175,869 shares taken up. £40,803 5s. paid on 163,213 shares. £3,164 considered as paid on 12,656 shares. Mortgages and charges, nil.

Wand & Mitchell, Ltd.—Capital, £500 in £1 shares. Return dated September 30th, 1930 (filed January 23rd, 1931). 302 shares taken up. £302 paid. Mortgages and charges, nil.

John Richards & Co., (Electrical Engineers), Ltd.—Capital, £6,000 in £1 shares. Return dated April 10th, 1931. 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges, nil.

Loud Speaker Co., Ltd.—C. D. Haynes, of 93, Mortimer Street, W.1, was appointed receiver and manager on May 2nd, under powers contained in debenture dated June 20th, 1930.

Electrical & Radio Products, Ltd.—Issue on May 9th of £1,000 debentures, part of a series already registered.

J. Poore & Sons, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1930 (filed April 9th, 1931). All shares taken up. £1,000 considered as paid. Mortgages and charges (at March 14th, 1931): £312.

Radio Service (London), Ltd.—Capital, £1,000 in £1 shares. Annual return dated December 31st, 1930, and return of allotments dated February 18th, 1931. All shares taken up. £6 paid. £994 considered as paid (capitalisation of reserve). Mortgages and charges: £1,500.

Peterborough General Electric Co., Ltd.—Capital, £500 in £1 shares. Return dated October 18th, 1930 (filed March 4th, 1931). All shares taken up. £500 paid. Mortgages and charges, nil.

Electrical Wiring Investment Co., Ltd.—Capital, £5,000 in £1 shares. Annual return dated November 25th, 1930, and return of allotments dated December 10th, 1930 (the latter filed March, 1931). 4,000 shares taken up. £4,000 paid or due and payable. Mortgages and charges: £700.

Winkworth Electric Car-Bells, Ltd.—Capital, £100 in £1 shares. Return dated March 9th, 1931. All shares taken up. £2 paid. £98 considered as paid. Mortgages and charges, nil.

City Notes

Oriental Telephone & Electric Co., Ltd.

The annual meeting was held on May 12th, Sir A. Henry McMahon (chairman) presiding. In presenting the report and accounts (ELEC. REV., May 8th, p. 803), the chairman said the Singapore branch showed a drop both in gross revenue and in the number of exchange lines connected, but as the charges against the revenue had been appreciably less, the net result for the year showed an improvement. Conditions throughout the period had been unfavourable, and until some revival in the tin and rubber industries, and in trade generally, took place, it would be idle to look for any improvement in Singapore. The cost of the automatic telephone system had fully justified itself. In the case of their Mauritius branch, prospects had begun to look a little brighter, but, unfortunately, the island had just been visited by one of the worst cyclones that had occurred for many years past. Although the full extent of the damage sustained was not yet known, it was very serious and must retard the tendency towards recovery. Fortunately a large proportion of their wires had been placed underground during the last few years, so that the damage to their installation could not be so great as would otherwise have been the case. Their associated undertakings in Bombay and Bengal had suffered from the political and industrial unrest, but some improvement was indicated since the beginning of the current year. Although the Rangoon Telephone Co. had paid the same dividend as for 1929 (6 per cent.), trade conditions were still bad, and showed little sign of improvement. The results attained by the Madras Telephone Co., despite a cyclone in November last, were very satisfactory, while the Hongkong Telephone Co., in which they were largely interested, continued to make excellent progress. The work of installing a trunk-line cable between Hongkong and Canton was well under way, and speech between these two cities would soon be possible. The report and accounts were adopted.

Cawnpore Electric Supply Corporation, Ltd.

Presiding at the annual meeting on May 12th, Mr. J. G. B. Stone (chairman), before presenting the report and accounts (ELEC. REV. May 8th, p. 802), referred with regret to the death of Mr. A. P. Simpson, a director. Turning to the company's operations during the year, he said it was satisfactory to know that the recent disturbances in Cawnpore had not seriously affected their business. The capital expenditure in India now totalled £672,518, of which £43,210 was spent during the year under review. Mr. K. A. Scott-Moncrieff, in seconding the resolution for the adoption of the report and accounts, said that the supply of electricity had been well maintained, and the cost of generation kept at a satisfactory figure. They had added five miles of new mains, and had been engaged in new construction at the power station. A satisfactory preliminary run had been made on the new 12,500-kW set, but there had been some delay in bringing it into operation through the late delivery of the new switchgear. This switchgear was of the latest type and was designed to cover extensions for many years to come. They had in sight new business which would already go a long way towards finding a load for the new plant, and it would appear that the time was not far distant when the increasing demand for electricity would call for still further extensions. The report and accounts were adopted.

Lancashire Electric Light & Power Co., Ltd.

The trading profit of the subsidiary companies (the Lancashire Electric Power Co. and the Ormskirk Electric Supply Co., Ltd.) for 1930, plus interest, was £249,715, and a balance of £6,105 brought forward is added, making £255,820. After providing for income tax, depreciation, &c., the balance paid over to the Electric Light and Power Co. amounts, with management fees, &c., to £216,945. The company's net balance is £169,687, and with £3,808 brought forward, the total available is £173,498. The dividend recommended on the ordinary shares is 6½ per cent. (against 7 per cent.), leaving £7,957 to be carried forward. The report states that the textile industry, together with other industries in Lancashire, upon which the Parliamentary Co. mainly depends for its trading, experienced during the year an unexampled period of depression, and although the trading results show some decrease, in the circumstances the results are deemed satisfactory. Mr. H. C. Levis and Dr. H. F. Parshall, in consequence of ceasing to reside in this country, have resigned their seats on the board, and the vacancies have been filled by the election of Mr. W. C. Lusk and Mr. C. D. Taite. The electrical energy generated or purchased totalled 253,459,310 kWh, as against 230,543,124 kWh in 1929.

Urban Electric Supply Co., Ltd.

The directors' report for the year ended December 31st last shows a net profit of £102,769, to which is added £26,029 brought forward, making a total of £128,798. From this the following appropriations are recommended:—Depreciation reserve, £30,000; general reserve, £5,000; staff benevolent fund, £2,000; writing off increased share capital expenses, £2,238. A final ordinary dividend of 4 per cent. is proposed, making 7 per cent. for the year (as for 1929), leaving £19,559 to be carried forward. During the year the transfer of the Godalming undertaking to the Aldershot Gas, Water and District Lighting Co., Ltd., was carried through, and the proceeds of the sale are being applied towards the redemption of the 4½ per cent. first mortgage debenture stock. The Twickenham, Teddington, Hampton and Hampton Wick undertakings of the Twickenham subsidiary company were, at the end of the year, transferred to the London and Home Counties Joint Electricity Authority, and sufficient of the proceeds of the sale was set aside for the redemption of the company's 5½ per cent. mortgage debenture stock. During the year the capital was increased by the creation of 250,000 £1 ordinary shares. Control of seven companies in the West of England has been acquired.

Ruths Steam Storage, Ltd.

An extraordinary general meeting is to be held to-day (Friday) for the purpose of considering resolutions for the reduction of the company's capital from £500,000 to £282,635. It it proposed that this shall be effected by cancelling 10s. of each of the 434,729 issued "A" and "B" ordinary shares of £1 each, reducing them to 10s. shares. It is then proposed to restore the capital to its former level (£500,000) by the creation of 434,729 new "A" ordinary shares of 10s. each. The existing unissued "A" ordinary shares will each be divided into two 10s. shares. The "B" ordinary shares are to be converted into "A" ordinary shares.

It is announced that if the reorganisation scheme is adopted, arrangements have been made for the company to acquire the whole of the capital of Ruths Accumulator A.B., the Swedish company which owns the whole of the Ruths rights outside the British company's territory.

Siemens Bros. & Co., Ltd.

A satisfactory report for the past year has been issued. It shows that the business of the company was well maintained, and that the profit rose from £314,465 to £335,114. The ordinary dividend is maintained at 7½ per cent., and the amount carried forward is £367,436, against £338,511 brought in. It is stated that the output was increased both in value and volume, and despite the adverse economic conditions, the balance of orders in hand at the end of the year was satisfactory. As in several former years, the shops devoted to the manufacture of submarine telegraph cables were again scantily occupied, and the cable steamer *Faraday* had to be laid up for most of the year. The death of Sir William Bull, Bt., who was a director of the company, is recorded. The meeting was to be held yesterday (Thursday).

American and Foreign Power Co.

The directors of this company, the large United States public utility combine controlled by the Electric Bond & Share Co., have declared a quarterly dividend of $1.75 per share on the second preferred stock, Series "A," for the quarter ended September 30th, 1930. Dividends, which are cumulative, will accrue after this payment as from October 1st, 1930. The company, which has expanded rapidly during recent years in South America, China, India, and other quarters, invested the proceeds of the issue of second preferred stock in new

properties, most of which are not yet on a full earning basis. During 1930 subsidiaries of the company expended over $52,000,000 (£10,400,000) in new and enlarged power plants.

It is reported that the company has acquired from the Bucharest Municipality the electric light, power and gas undertakings owned and operated by the city authorities, subject to Government approval. Endeavours are also being made to take over privately-owned hydro-electric undertakings in the neighbourhood of the city. The expenditure is said to be about £2,400,000.

Craigpark Electric Cable Co., Ltd.

Dr. Magnus Maclean, chairman, presided at the annual meeting of shareholders in Glasgow on May 11th, and in moving the adoption of the report and accounts (ELECTRICAL REVIEW, May 8th, p. 802), stated that the general depression in trade had affected the company throughout the whole year. The result was a big reduction in sales while as regarded the export trade, especially to Australia, they were doing very little business. In addition, the steady fall throughout the year in practically all raw commodities used in the manufacture of cables caused a reduction in selling prices, thereby affecting considerably the monetary value of the output. The directors felt that, notwithstanding these adverse factors, the company had weathered the difficulties satisfactorily, and, with large orders in hand at the moment, together with the fact that they were opening new accounts, the prospects at present appeared to be good. The report and accounts were adopted.

Chloride Electrical Storage Co., Ltd.

A net profit of £263,009 is reported for the year ended March 31st last; this compares with £287,163 for 1929-30. The ordinary dividend is 15 per cent., free of tax, against 30 per cent. for the previous year, but during the year the ordinary capital was doubled by a bonus issue. The reserve receives £97,438, as compared with £100,000, raising the fund to £300,000, and £11,500 is again contributed to the employés' funds. The amount carried forward is £80,505, against £85,824 brought in. Meeting: To-day (Friday).

Electrical Finance and Securities Co., Ltd.

The report for 1930 shows a credit balance, after deducting debenture interest, &c., of £20,107, to which is added £9,175 brought in, making £29,282. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 10 per cent. for the year, and a bonus of 2½ per cent., less tax, leaving £9,325 to be carried forward. Reference is made to the progress made by the following supply companies in which the company is interested: Northwood Electric Light & Power Co., Ltd.; Foots Cray Electricity Supply Co., Ltd.; Colne Valley Electric Supply Co., Ltd.; Boston and District Electric Supply Co., Ltd.; and Lothians Electric Power Co.

The report of the *Iron Trades Employers' Insurance Association, Ltd.*, for 1930 shows that the premium income amounted to £673,536, which, with dividend and interest, and £44,959 brought forward, makes £817,492. Compensation and incidental expenses totalled £512,235, and after providing for management expenses, &c., there is a balance of £240,235. Out of this it is proposed to return 15 per cent. of the Workmen's Compensation premium paid for 1930, together with a bonus of 15 per cent., on which income tax has already been paid.

The accounts of the *East Anglian Electric Supply Co., Ltd.*, for 1930 show a net profit of £6,654 and a balance brought in of £2,414. After providing for preference dividend, and writing off stamp duty and expenses on the increase of capital, £6,876 is carried forward. Since the end of the year Sir James Devonshire has resigned from the board, and Mr. F. Massingberd Rogers has been appointed chairman.

The net revenue of the *Birkdale District Electric Supply Co., Ltd.*, for 1930 is £14,499, and after deducting expenses, debenture interest, &c., the balance available is £8,166. It is proposed to place £5,000 to general reserve and to pay a dividend of 6 per cent. (same), leaving £6,059 to be carried forward.

Great Northern Telegraph Co., Ltd. (of Denmark).—The report for 1930 shows net receipts of £403,379, against £441,489 in 1929. The total dividend and bonus is, however, maintained at 20 per cent. for the year.

The directors of *Dorman, Long & Co., Ltd.*, have decided to postpone the payment of the dividend on the 6 per cent. cumulative preference shares.

The revenue of the *Gateshead and District Tramways Co.* for 1930 was £124,760, and the net profit was £27,776, to which is added £20,309 brought forward, making £48,085. The ordinary dividend is 8 per cent. and £23,667 is carried forward. Mr. T. Hornsby and Mr. W. M. Teasdale have been appointed directors.

Dividends of 6 per cent. are to be paid on both the preference and ordinary shares of *Philips' Glowlamp Works* for the past year, against 9 per cent. and 21 per cent., respectively, for 1929.

The net revenue of the *Sheerness and District Electric Supply Co., Ltd.*, for 1930 is £19,103 (as against £20,060 in 1929). After deducting expenses and loan interest and placing £5,000 to reserve, a dividend of 10 per cent. (same) is to be paid, leaving £3,515 to be carried forward.

Agar, Cross & Co., Ltd., the Argentine export agents, report that prevailing conditions in the Republic and the depreciated exchange have rendered the payment of an interim ordinary dividend undesirable, although the preference dividends are to be paid. The usual interim ordinary dividend is 5 per cent., free of tax.

The *English Electric Co. of Canada* reports a profit of $220,929, which the allocation to depreciation reduces to $189,929, against $300,830 for 1929. After meeting the dividend on the class "A" stock a balance of $60,929 (against $180,830) remains for distribution on the "B" stock.

A dividend of $0.90 per share on the common shares is announced by the *Consolidated Gas, Electric Light and Power of Baltimore.*

German Company.—Despite depressed industrial conditions, increased profits are shown in the report for the year ended March 31st, 1931, of the *United Industrial Enterprises Co.* ("*Viag*"), of Germany, the holding company which controls all the industrial enterprises of the Reich. Dividend receipts rose during the year to £913,750, as compared with £800,000 for the year 1929-30. After all deductions, there is a net profit of £509,231, against £598,870. The directors have declared a dividend of 7 per cent. for the year, against 8 per cent. for 1929-30. The holdings of the company include the control of the largest electrical power system in Europe, and of the entire German aluminium industry, and have a total value of £12,211,150. The capital is to be increased by £1,000,000 to £9,000,000.

Stocks and Shares

TUESDAY EVENING.

THE fall in the Bank Rate to 2½ per cent. had no strengthening effect upon Stock Exchange markets, other than those concerned with British Government and allied securities. The fact that the Banks are not making any reduction in their charges of 5 per cent. for loans, or giving less for deposit rates than 1 per cent., appears to rob the fall in Bank Rate of its usual assistance to trade. Moreover, the change is generally recognised as being due to the condition of industrial slackness which prevails, and which renders money a drug in the market, as the saying goes, rather than to any factor likely to stimulate business at the present time in the face of the unfavourable elements which confront it. The gilt-edged stocks are advantaged, of course, by the fall in the Rate, because the latter is taken as being an unmistakable hint that the Government has in mind the intention of converting, at some early date, the 5 per cent. War Loan, of which there is two thousand millions in issue. The 4½ per cent. stocks of the Central Electricity Board and the London & Home Counties J.E.A. are each a point up at 97, and are by no means easy to obtain, while the list of T.F.A. stocks show a further restriction owing to the demand that there is for purely gilt-edged securities. London Power 5 per cent. debenture has risen 1 to 104.

Tube Railway Stocks

Further falls have taken place in the Home railway market, Metropolitans in particular being flat at 46½ and difficult to sell. Districts are 4 points down at 65½; Central London assented ordinary has gone back to 76. Efforts are being made to estimate the proper value which should be placed upon the price of Metropolitan consolidated, and, to do this, comparison is being made with the stock that will be given in exchange for Metropolitan District ordinary. Taking the dividends paid by the two railway companies on their ordinary stocks as the basis, it is assumed that the Metropolitan will receive £65 of the new London Transport Passenger Board "C" stock. Valuing the latter at, say, £70, this would give about 45½ for Metropolitan consolidated ordinary. The calculation is, of course, based upon inference, and many things may happen before the Bill comes into operation, but it is upon this consideration that the price of the stock has fallen, to-day's price comparing with 74½ reached at one time last year, and 68¾ as the highest in the present twelve-month. Underground Railway shares are down to their par level of 20s.

Electricity Supply Shares

The necessity which prevails nowadays to provide cash for meeting speculative and other obligations is reflected in the dulness which has overtaken shares in the Electricity Supply market. Metropolitans are ¼ down at 38s. Electric Supply Corporation, at 46s. 3d., show a loss of 1s. 9d. South Londons are 6d. lower. Other shares in the London group are practically unchanged, but, whereas six months ago the shares were extremely difficult to buy, the position to-day is reversed, and it is by no means easy to obtain a bid for any material number of shares even of the best-class electricity supply companies.

The basis of yield is being rearranged, and it will be noticed that the London companies will now give an average of about 5 per cent. on the money, a rate which, for industrial shares, is still so modest as to imply that holders in the companies are content to retain their investments as being solid securities. North Metropolitan Electric 5 per cent. mortgage debenture at 102 is 4 points better.

Provincial Electricity Shares

Shares in the provincial electricity supply companies are heavy, mainly by reason of general conditions that are supplemented by the fear lest dividends may have to be lowered. The reduction of ¼ per cent. in the Lancashire Electric distribution has brought about a further fall of 1s. 9d. in the price of the shares, lowering this to 21s. 3d. Newcastle ordinary, although the dividend was maintained, are 1/16 lower at 21s. 3d. Yorkshire Electrics have fallen ¼ to 1¼. Scottish Power are weak at 26s. 3d., but the preference, at 24s., are rather harder. Bournemouth & Poole have lost 2s. 6d. at 56s. 3d. The Lancashire Electric report is worth attention, as shedding light upon the conditions under which the provincial companies are working. Smaller consumers are taking more electricity; it appears to be the large users—factories, &c. —whose demand has fallen off, owing, of course, to slackness of trade.

Cables and Wireless

It can hardly be supposed that there will be anything pleasant to say about Cables & Wireless stocks at a time when most of the other markets are depressed. The company's 5½ per cent. preference stock is 2 down at 51½. The two ordinary stocks are lower, the "B" ordinary giving way to 6, while the "A" ordinary is 3¼ down at 11½. The price of Globe ordinary is 10s. weaker at 9½. Great Northern Telegraphs are 25s. down; Marconi Marines have gone back to 28s. 9d., showing 3/16 fall. Anglo-American Telegraph preferred stock at 103½ is the fraction higher, which seems a little anomalous in view of the fresh falls that have occurred amongst American utility issues. The Post Office has announced its intention of developing the telephone, and the Post Office and Telegraph Money Bill has been read a second time, authorising the raising of 32 million pounds for the development of the postal, telegraph and telephone services. New York and Chicago, according to the Assistant Postmaster-General, are the only two towns which have more telephone subscribers than London has. The Postmaster-General was told during the discussion on the Bill that he would do a real service by handing over his department to a public utility corporation.

Manufacturing Shares

The prospect of substantial increase in the amount spent in connection with telephone development has failed to prevent renewed weakness amongst the shares in the manufacturing and equipment companies. Falls have occurred in Henley's, Enfield Cables, Callender's, British Insulated, British Aluminium, Crompton Parkinson, and others. Brush ordinary is down 2½ points to 65, making a drop of 40 points within three weeks. The chairman explained at the meeting that the extension of electrical supply by the grid system had operated unfavourably in the case of the Brush Company. The present price of 65 is 96 points less than the hypothetical value set by a Stock Exchange firm upon the stock, as calculated upon the company's assets. The trouble is, of course, that there are many companies nowadays which occupy sound financial positions, but whose earning capacity is severely affected by the unhappy conditions of trade generally. Philips' Incandescent Lamp Company, with its 7½ millions capital, recommends a dividend of 6 per cent., against 21 per cent., on the ordinary shares. The preference, which received 9 per cent. last year, are to get 6 per cent. for the period just ended. The price of the ordinary shares has fallen to 22s. 6d., and the dividend announcement is stated to have caused keen disappointment on the Amsterdam Bourse. Siemens shares continue dull at £1. The report makes a good showing, and states that, except in the submarine cable section, the balance of orders in hand is satisfactory.

Miscellaneous Matters

Babcock & Wilcox are weaker at 38s. 9d. Iron and steel shares as a whole continue very much on the dull side. Vickers are lower at 6s. 1½d. A slight improvement in the price of rubber to 3¼d. per lb. had no quotable effect upon the prices of the rubber shares. Amongst traction issues, a fall of 375 points in British Electric Traction deferred ordinary looks sensational, following as it does a drop of 100 points last week. When stock reaches a price like this, it is obvious that if either supply or demand appears, its effect is bound to be extremely marked. The company's 8 per cent. preferred stock has shed 5 points at 122½. Mexicans are lower, Mexican Light and Power losing 5 points to 37½. Brazilian Tractions have weakened to 15. American Telephone and Telegraph dropped 7½ to 180; Internationals are 3 points lower at 26. Shawinigan Water fell 2 to 42. Montreal Light and Power shares are lower at 54, and Power Corporation of Canada at 49½ are also down on the week. Atlas ordinary gave way to 15s. 9d. Perak River Hydro-Electrics drooped to 3s. Tokyo 6 per cent. bonds weakened to 94. It is at least pleasant, in the face of this week's melancholy recital, to report that Drake & Gorham 5½ per cent. debenture is 2 points up at 97.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES†

	Nom.	Approx. Dividend 1929.	1930.	Price May 19 1931.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	56/3	—¼	5 6 8
Brompton Ordinary	1	8½	8½	28/-		5 0 0
Central Electricity 4½% Deb.	Stock	—	—	97	+1	4 13 0
Charing Cross Ordinary	1	8	8⅛	29/6	—	4 15 0
Chelsea	1	8⅝	8⅝	27/6	—	5 1 10
City of London	1	10	10	96/3	—	5 10 8
Clyde Valley	1	8	8	28/9	—⅛	5 11 4
County of London	1	7	10	43/3	—6d.	4 12 6
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	46/3	—1/9	4 15 2
Kensington Ordinary	1	8	8	29/6	—	4 15 0
Lancs. Light and Power	1	7	6½	21/3	—1/9	6 2 4
London & Home Counties 4½% Deb.	Stock	—	—	97	+1	4 13 0
London Electric	1	8½	9	34/-	—	5 5 11
Metropolitan	1	9	10	38/-	—1/6	5 5 3
Midland Counties	1	6½	7	26/3	—⅛	5 6 8
Mid. Elec. Power	1	15	8	27/6	—⅛	5 16 5
Newcastle-on-Tyne Ordinary	1	6	6	21/3	—⅛	5 13 0
do. 7% Pref.	1	7	7	27/-	—	5 3 8
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref.	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	28/6	—	4 18 3
Scottish Power	1	8	8	26/3	—1/9	6 2 0
South London	1	8½	8½	27/6	—6d.	5 1 10
Urban Ordinary	1	7	7	28/-	—9d.	5 0 0
Westminster Ordinary	1	8½	8½	28/6	—	4 18 3
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	30/-	—¼	5 6 8

HOME RAILS

Central London Ord. Assented	Stock	4	4	76	—1	5 5 3
Metropolitan	,,	4	9½	46½	—3	7 10 6
do. District	,,	5	5	66½	—4	7 12 8
Underground Electric	£1	8	8	20/-	—6d.	8 0 0

TELEGRAPHS AND TELEPHONES

Anglo-Am. Tel. Pref.	Stock	6	6	108½	+½	5 16 0
do. Def.	,,	1½	1½	25½	—	5 17 8
Automatic Telephone	1	12½	12½	32/6	—½	7 13 10
Cables & Wireless 5½% Pref.	Stock	5½	5½	51½	—2	10 18 8
do. A 7½% Ord.	,,	Nil	—	11½	—3½	... ...
do. B Ord.	,,	Nil	—	6	—4	... ...
Globe Tel. and T. Ord.	10	10	—	9½	—½	... ...
do. do. Pref.	10	6	6	10	—	6 0 0
Great Northern Tel.	10	20	20	28	—1½	7 2 10
Marconi-Marine	1	15	15	28/9	—⅞	10 8 6
Oriental Telephone Ord.	1	12	12	2⅝	—	*5 1 0

HOME AND FOREIGN TRAMS, &C.

Anglo-Arg. Trams First Pref.	5	5½	—	15/-	—¾	... ...
do. do. 2nd Pref.	5	6	—	7/6	—5/-	... ...
do. do. 5% Deb.	Stock	5	5	22½	—8	21 4 4
British Electric Traction Def. Ord.	,,	5	5	775	—375	... ...
do. do. Pref. Ord.	,,	8	—	122½	—5	6 10 8
Brazil Traction	100	8	—	15	—1½	... ...
Brit. Columbia Elec. Rly. Pfd.	Stock	5	5	97½	—	5 2 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	11/6	—6d.	... ...
London United Tram Deb.	Stock	4	4	62½	—	6 8 0
Mexico Trams, 5% Bonds	—	5	5	45½	—5	10 19 10
Mexican Light Common	100	Nil	Nil	37½	—5	... ...
do. 7% Pref.	100	7	7	69½	—1	10 1 0
do. 1st Bonds	—	5	5	79	—1	6 6 7
Victoria Falls Ord.	1	15	15	58/-	—	5 3 5
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

MANUFACTURING COMPANIES

Assoc. Elec. Ord.	1	6	6	17/9	—1/6	6 15 2
do. Pref.	1	8	8	27/6	—	5 16 0
Babcock & Wilcox	1	13	14	38/9	—3/3	*7 4 4
British Aluminium Ord.	1	10	10	25/-	—2/-	8 0 0
British Insulated Ord.	1	15	15	2±	—⅜	6 13 4
Brush Ord.	Stock	10	5	65	—2½	7 13 10
Callenders	1	15	15	2⅞	—⅜	6 3 0
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	30	30	1	—⅛	7 10 0
do. 8% Pref.	1	8	8	28/-	—	5 14 5
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	94½	—	5 5 10
Electric Construction	1	5	5	12/6	—	8 0 0
Enfield Cable Ord.	1	25	25	3¾	—	6 18 1
English Electric	1	Nil	Nil	5/-	—	... ...
do. do. Pref.	1	Nil	Nil	5/-	—9d.	... ...
Ferranti Pref.	1	7	7	21/6	—	6 10 4
G.E.C. Pref.	1	6½	6½	26/-	—	5 0 0
do. Ord.	1	14	14	37/6	—2/-	7 9 4
Henley	1	30	30	4½	—⅜	6 13 4
do. 4½% Pref.	5	4½	4½	4½	—	5 2 10
India-Rubber	1	Nil	Nil	5/-	—	... ...
Johnson & Phillips	1	10	10	27/6	—	7 5 6
Siemens Ord.	1	7½	7½	1	—	†10 0
Telegraph Construction	12	10	7½	18	—½	6 13 8

*Dividends paid free of Income Tax.

Our Foreign Electrical Trade

Electrical Exports and Imports during April

THE Board of Trade returns of our external trade during April show that although there was a small general decline as compared with March, this was entirely due to the incidence of the Easter holidays. Against the April, 1930, figures, however, the reductions in both imports and exports were substantial, amounting to 16.5 per cent. and 30 per cent., respectively. It is considered that the fall in prices during the past year is mainly responsible for the smaller values.

So far as electrical exports were concerned, a level was reached which was the lowest since June, 1924—nearly seven years ago. The import total also continued its downward trend, and fell to the lowest point since September, 1928, just before the commencement of the upward movement which persisted during the whole of 1929 and after.

Making due allowance for Easter, it will be found that the April export total is not far behind that of March. The fall as compared with that month was largely due to smaller shipments of telegraph and telephone cable and material, the decline amounting in all to £60,037. Unenumerated goods fell by £23,459, and batteries and accumulators by £12,848. A substantial decrease in exports of unenumerated machinery (£52,910) was compensated for to a great extent by a rise of £42,980 in the other two machinery items. As compared with the corresponding month of last year the fall in the total was most marked, being in the neighbourhood of 25 per cent. For this lower cable exports must be blamed mainly. The decline in this item was well over 50 per cent., and the position was worsened by further declines in submarine and non-submarine telegraph cables. In the machinery section, too, there was a considerable fall, for in spite of increased exports of traction motors, the section as a whole registered a decrease of £100,134, or 21 per cent.

So far as imports were concerned, the April total was only £13,713 lower than that of the previous month, which means that Easter made very little difference to the trade. The only substantial decline was that of £18,202 in unenumerated goods and apparatus, but against this there was a rise of £10,816 in the value of imports of telegraph and telephone apparatus.

Comparing the figures with those for April, 1930, however, a decline of 24½ per cent. in the total is disclosed, which is of the same order as the decrease in the export total. The item "meters and instruments," which reached abnormal proportions last year, thought to be due mainly to talking-film apparatus, fell further—the reduction being no less than 80 per cent. Cables and machinery also shared responsibility for the lower total, the decline in the case of the latter item amounting to about 27 per cent. It will be seen that the decrease in imports during the first four months of the year was proportionately far greater than the decrease in exports during the same period. Re-exports also showed a decline.

Electrical Machinery Exports

Destination	Quantities Apl., 1930 Tons	Quantities Apl., 1931 Tons	Quantities Inc. or dec. Tons	Values Apl., 1930 £	Values Apl., 1931 £	Values Inc. or dec. £
Europe ...	435	464	+ 29	85,801	76,771	− 9,030
Japan	39	1	− 38	5,517	1,014	− 4,503
South America ...	280	247	− 33	44,966	38,400	− 6,566
South Africa ...	237	207	− 30	42,538	27,975	−14,563
British India ...	556	426	−130	81,740	70,195	−11,545
Australia	437	17	−420	56,686	3,915	−52,771
New Zealand ...	364	205	−159	35,973	32,139	− 3,834
Canada	146	374	+228	22,539	45,104	+22,565
Other countries ...	668	516	−152	99,554	79,667	−19,887
Total ...	3,162	2,457	−705	£475,314	£375,180	−£100,134

Exports of electrical machinery during April are analysed in the inset table to show their distribution. The only satisfactory feature of the list is the noteworthy advance in shipments to Canada, by which the Dominion's quota for April, 1930, was doubled. During the first four months of this year Canada has imported British electrical machinery to the value of £119,904, as compared with £88,496 in the corresponding period of 1930. The least satisfactory item is Australia, whose imports of this class are dwindling at an alarming rate. The shares of South Africa and "other countries" also showed considerable shrinkage. It may be pointed out that in spite of the general fall in price levels during the past year or two, the value per ton of exported electrical machinery remained practically the same, *i.e.*, approximately £153. At the same time, the value of imported machinery rose from £316 to £349 per ton.

	Exports. Electrical exports for April, 1931.	Exports. Inc. or dec. as compared with March, 1931.	Exports. Inc. or dec. as compared with April, 1930.	Imports. Electrical imports for April, 1931.	Imports. Inc. or dec. as compared with March, 1931.	Imports. Inc. or dec. as compared with April, 1930.	Re-Exports. Electrical re-exports for April, 1931.	Re-Exports. Inc. or dec. as compared with March, 1931.	Re-Exports. Inc. or dec. as compared with April, 1930.
Electrical goods and apparatus (unenumerated)	£169,701	−£23,459	−£31,058	£99,892	−£18,202	−£11,863	£4,877	−£1,004	−£3,497
Insulated cables and wires ...	114,530	− 3,972	−141,532	61,147	+ 4,014	− 18,681	370	+ 152	+ 22
Glow lamps	30,912	+ 998	− 4,192	20,672	+ 1,140	− 1,554	239	+ 68	− 797
Arc lamps and parts	419	− 606	− 734	4,076	+ 229	+ 2,281	160	+ 151	+ 71
Batteries and accumulators ...	50,031	− 12,848	− 21,361	31,721	− 9,168	− 1,353	316	− 10	− 92
Meters and instruments ...	29,489	+ 5,556	− 1,391	25,947	− 6,086	− 110,297	359	− 80	− 1,493
Carbons	823	− 4,714	− 311	14,654	− 3,321	− 1,232	377	− 360	+ 235
Switchboards (not telegraph or telephone)	2,392	+ 95	− 1,880	73	+ 61	− 46	9	− 39	+ 9
Electrical Machinery—									
Electrical machinery (unenumerated)	194,513	− 52,910	− 92,653	118,902	+ 6,258	− 44,248	9,655	− 3,515	+ 284
Railway and tramway motors	19,959	+ 12,799	+ 15,697	—	—	—	—	—	—
Other motors and generators...	160,708	+ 30,181	− 23,178	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cables (not submarine)	54,252	− 28,303	− 16,837	3,122	+ 546	+ 969	42	− 107	+ 42
Submarine telegraph and telephone cable	10,414	− 12,701	− 10,150	—	—	—	—	—	—
Telegraph and telephone apparatus	211,020	− 19,033	− 32,020	114,725	+ 10,816	+ 27,990	8,380	− 319	+ 1,129
Total	£1,049,163	−£108,9 7	−£361,600	£494,931	− £13,713	−£158,034	£24,784	− £5,063	− £4,087
Decrease for first four months of the year		Exports £1,855,080			Imports £1,084,364			Re-Exports £102,243	

Great Britain's Radio Exports

According to the *Wireless and Gramophone Trader*, the exports during March of radio apparatus of United Kingdom manufacture had a total value of £70,000, comprised of valves £20,069, receivers £8,658, transmitting apparatus £15,032, and other parts and accessories £26,243. For valves, France, Australia, Argentina, and Belgium were the principal customers; for receivers—the Irish Free State, Belgium, and South Africa; for transmitting apparatus—Kenya, Roumania, Spain, and Somaliland Protectorate; and for other parts and accessories—Italy, Australia, the Netherlands, and Belgium.

Tenders for Argentine Government Contracts

A memorandum regarding the conditions governing the submission of tenders for Government contracts in Argentina, together with details of some of the special conditions applicable to tenders for certain of the departments, prepared by the Commercial Counsellor to H.M. Embassy at Buenos Aires, has been received in the Department of Overseas Trade and issued to firms whose names are entered on its Special Register. British firms desirous of obtaining a copy of this memorandum should apply to the Department, 35, Old Queen Street, S.W.1. (Reference No. C.X.3527.)

Danish Industry and Trade

IN a recent D.O.T. report upon economic conditions in Denmark (Stationery Office, 2s. net), Mr. H. H. Cassells, Commercial Secretary at the British Legation, Copenhagen, states that the country remained practically unharmed by adverse world conditions until the end of last year. Then agriculture, the country's staple industry, commenced to feel the pinch of low prices, and now the country has entered upon a period of economic stress.

There was a shrinkage in Denmark's foreign trade in 1930, while the excess of imports over exports rose to a considerable extent. Trade with Great Britain was affected by the general decline, but the balance in Denmark's favour remained at about the same level. On the other hand, Germany's exports to Denmark rose, while Danish exports to Germany fell, further increasing the balance in favour of Germany. With the exception of textile machinery, Great Britain secured a smaller share of the machinery business than Germany.

Great Britain's share of the total Danish imports was 14.5 per cent. (against 14.7 per cent. in 1929); on the other hand, the proportion of Denmark's exports sent to this country rose from 56.4 to 58.8 per cent.

Foreign Electrical Trade

In 1929 Denmark's imports of electrical machinery and other equipment had a total value of 20.6 million kr. (about £1,077,000), as compared with 18.5 millions (£1,016,000) in the preceding year. The principal item in 1929 was radio apparatus (6.5 million kr.), of which Germany supplied nearly 60 per cent. and Great Britain something less than 4 per cent. Dynamos, motors, transformers, &c. (4.4 million kr.) were next in importance, and in this class Great Britain secured the lead from Germany, supplying over 34 per cent., to Germany's 30 per cent.; the United States was responsible for about 9 per cent. Installation material valued at about 2.1 million kr. was imported; Germany supplied over 70 per cent. of this.

With regard to electrical exports the total value rose from 15.4 million kr. (£846,000) in 1928 to 17.1 millions (£940,000) in 1929. In each year batteries and cells (including flash lamps) accounted for more than half of the total; in 1929 Great Britain superseded Sweden as the principal importer of these goods, and also took a large proportion of exported dynamos and motors. This country's share of the total Danish electrical exports rose from about 18 per cent. in 1928 to nearly 20 per cent. in 1929. It is noted that the Danish cable and wire works were well occupied with orders for both domestic and export trade in 1930.

Goodwill towards Great Britain

The relatively small percentage of the Danish import trade secured by the British manufacturers is ascribed in the first place to the higher prices of their products, and to some extent to inadequate marketing methods. Mr. Cassells says that no one is more anxious that the average Danish business man to welcome an increase in British imports to Denmark, but goods must be brought to his notice, and they must be competitive and as suitable for local requirements as the products they are intended to supplant. There is in Denmark, as perhaps in few other foreign markets, a general readiness to give a reasonable measure of preference to British over other foreign goods. Material proof that this goodwill exists was again forthcoming in 1930, when certain British manufacturers, partly in consequence of it, were successful in obtaining the two largest contracts awarded during the year by Danish public authorities.

Railway Electrification

The Government has sanctioned the expenditure of about 17 million kr. on a scheme to electrify about 39 km. of the Copenhagen suburban lines. The work, which it is expected to occupy five years, includes the construction of a double track on certain sections and the erection of some additional stations. Most of the material required will be purchased in Denmark. As a means of helping the private railways to meet road competition by the modernisation of their systems, it is proposed to grant them a State loan of 11.5 million kr. The State is a large shareholder in these companies. Part of the loan will probably be spent in Diesel-electric or petrol-electric coaches to replace steam traction.

Radio Communication

The number of licensed owners of radio receiving sets continues to increase at the rate of about 25,000 per quarter, and reached a total of about 380,000 (including 50,000 users of crystal sets) in September last.

The Government and commercial radio-telegraph station at Lyngby, near Copenhagen, is being modernised and transferred to a more distant part of the country to reduce interference with the broadcasting of the Copenhagen wireless programmes. The new station, which is situated at Skamlebaek on the north-west coast of Sjaelland, is designed for transmitting on both short and long wave-lengths and the station will be fitted with twelve units for different services, including aviation, shipping, the Press, and communications with foreign countries. The improved installation will allow of direct communication with Greenland, America, and Eastern Asia. The short-wave transmitter, a 20-kW installation, was supplied by the Telefunken Company.

An East African Electrical Market

THE British Consul-General at Lourenço Marques has transmitted a report on the market for electrical supplies in Portuguese East Africa to the Department of Overseas Trade. Although the market is a small one, the demand is growing and some of the information contained in the report may be of service to British exporters of electrical equipment.

The public electricity supply in Lourenço Marques is furnished by a British-controlled company at 240/480 V d.c. and, to a small extent, at 240/120 V a.c. The bulk of the plant and the cables are of British manufacture. The Port and Railways Board has a 1,200-kW station for its own purposes and there are two other private plants. With regard to the territory of the Mozambique Company, there are two power stations in Beira, one belonging to a British company and the other to the municipality supplying at 220/440 V d.c. The report also gives particulars of other small stations in various towns in the territory.

The Competitive Position

There is no local production of electrical material and, apart from Government Departments and a few of the more important companies producing power, only one or two firms at Lourenço Marques and Beira are competent to effect any but the simplest repairs. British imports, both direct and through the Union of South Africa, predominate; the United States appears to hold a monopoly in the growing trade for refrigerators for domestic and hotel use; and German competition is keen in some lines, particularly fittings and accessories. General imports are usually effected through commission agents, although the larger concerns frequently place orders direct through their European offices or agents. Government requirements are obtained by public tender through firms established in the territory, and payment for ordinary requirements is generally made during the month following delivery; except in special cases, other buyers obtain up to 90 days' credit. Quotations are usually made c.i.f. port of destination, although public departments frequently require delivery at store.

Electrical Imports

A table appended to the report gives some details of the electrical import trade during 1929 on private account. It is seen from this that the greater part of the imports come under the heading "Machines for electricity and electric lighting." These had a total value of 138,712 gold escudos (£30,000) and Great Britain is credited with 52 per cent. of this. The Union of South Africa, Germany, the United States, and Rhodesia were also important suppliers. Great Britain also supplied the largest proportion of telegraph and telephone apparatus, with Sweden second. Electric generators, motors, and transformers came principally from the United States and the Union of South Africa. By far the greatest quantity of radio apparatus was supplied by Great Britain and the same may be said of wires and cables, but Germany held the premier position in the provision of lamps, cranes and accessories, and batteries.

Import Duties

The import duty upon electrical machinery amounts to one per cent. *ad valorem* and to 20 per cent. on all other electrical material entering the Government-administered territory. In the Mozambique Company's territory the *ad valorem* duty on electrical material is as follows: Insulators, conduit tubing, sockets, apparatus, machinery, cables, wires, &c., destined exclusively for electrical installations, three per cent.; machinery and apparatus for domestic use, *i.e.*, refrigerators, fans, motors, &c., 10 per cent.; and fittings of metal work such as brackets, &c., 10 per cent.

In addition to the above duties a municipal import tax of two per cent. *ad valorem* is levied in each case on goods imported into Beira.

Trade with British Malaya

The Department of Overseas Trade announces that Mr. R. Boulter, C.M.G., H.M. Trade Commissioner at Singapore, will shortly be in London on an official visit. Mr. Boulter will be available at the offices of the Department during the period June 1st to 12th to interview manufacturers and merchants interested in the export of British goods to British Malaya. Firms desiring interviews with Mr. Boulter should apply to the Comptroller-General, D.O.T., 35, Old Queen Street, S.W.1. (Reference 2861/1/31.)

Indian Duty on Radio Apparatus

The *Board of Trade Journal* reports the withdrawal by the Government of India of the reduced duty of 12½ per cent. *ad valorem* on apparatus designed solely for the reception of broadcast radio and such component parts of apparatus for radio-telegraphy or telephony as can be used as parts of apparatus for the reception of broadcast radio. These goods will therefore presumably become subject to the normal duty of 20 per cent. *ad valorem*. The reduced duty of 2½ per cent. *ad valorem* on other wireless apparatus and parts is maintained.

Book Reviews

The Electrical Equipment of Automobiles—a Book on Principles for Motor Mechanics and Motorists. By STANLEY PARKER SMITH, D.Sc., M.I.E.E. Second edition revised and enlarged. Pp. xii+198; figs. 75. London: Chapman and Hall, Ltd. Price 5s. net.

This is a second edition, revised and enlarged, of a work first published in October, 1927, and the fact that its issue has become necessary in a space of just over three years may be taken as evidence that it is appreciated.

Without going too deeply into Prof. Smith's book, it may be said that he thoroughly covers the subject, and that if the student assimilates the information it contains and supplements the knowledge with practical work he should be in a position to deal effectively with any derangement that may result in the faulty working of a motor vehicle's electrical installation or the immobilisation of the car itself. The book opens with chapters on storage batteries, the action of electrical machines, starting motors and generators, bulbs, headlights, and other small yet important items of the modern car's equipment. The importance of correct wiring is usefully stressed in a chapter on wiring systems and the location of faults. In view of the tendency of the times, the author gives priority in his explanatory remarks on ignition to the battery and coil, the once predominant magneto being relegated to second place. The book is an excellent one for students and one that can be recommended to the teachers of motor classes in any technical institute or polytechnic.

Die Grossen Chemie-Konzerne Deutschlands 1931. Pp. 128. Berlin: Verlag R. & H. Hoppenstedt. Price 6 Rm. (6s.)

As the title implies, the book before us deals with the present position of the chemical industry in Germany. It forms one of the series of books known as the "Special Archives of German Economics" and gives a complete record of the activities and ramifications of the principal concerns connected with the German chemical and electro-chemical industries. Following a long chapter dealing with the present position and future prospects of the trade, each of the big concerns is dealt with separately, the information given covering full details of the undertaking, its capital, the dividends paid over a series of years, &c. In view of the fact that the I. G. Farbenindustrie Gesellschaft of Frankfort-am-Main and its associated concerns are responsible for 35 per cent. of the capital invested in the German chemical industry, it is the first to be dealt with, the section occupying no fewer than 30 pages. That the I. G. Farbenindustrie is a power to be reckoned with is well known, but we imagine that a perusal of this book, which is, of course, printed in German, would astonish the majority of our readers as regards the ramifications of the company, which is interested not only in chemical manufacture but in such widely diverse things as aluminium and motor vehicles, not to speak of coal and lignite mines. The financial position of a dozen other large German chemical undertakings and their affiliated companies is also similarly dealt with.

Personal Problems—Methods and Analysis and Control. By FELIX E. BARIDON & EARL H. LOOMIS. Pp. vii+452. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

Management to-day is confronted with numerous complexities in dealing with groups of individuals working together, and the authors have made an attempt in this book to classify and co-ordinate personnel problems which employers in all spheres of industry are liable to encounter. The situations in which these problems are present are discussed in detail and methods are outlined for their analysis and control.

Among the aspects of the subject dealt with are employment, remuneration, maintenance of working force, employé progress, payments for absences, employé relations, centralised personnel control, health, safety, and working environment. In addition there is an appendix relating to the trend of company wages, the cost of living and wage rates, occupation codes, labour turnover problems, and the census of employés. A well-compiled index is appended.

The Flow and Measurement of Air and Gases. By A. B. EASON, M.A. Second edition revised. Pp. xii+254; illustrated. London: Charles Griffin & Co., Ltd. 20s. net.

The outstanding impression occasioned by a perusal of this book is the great care and industry displayed by the author in obtaining references to other associated works. Several hundreds of authors are quoted, the relevant literature of the world having been scanned apparently for the purpose. Consequently the bibliography is very complete. The subject matter covers flow in pipes, including pneumatic tube problems, of which the author has had considerable experience; measurement of air and gas including a chapter on hot wire anemometry, and air friction on moving surfaces.

No sweeping changes have been made in the new edition. Some particulars of grain- and coal-conveying plants have been added, giving the ratio of tons of material conveyed per hour to the horse power required. The tabulated information serves to emphasise the need for careful investigation into this important practical problem.

At the present time when the question of air friction on surfaces is most important in structural, aeroplane and motor-car engineering, one would have liked to have seen in the revised edition a more extensive treatment of this section of the subject. One brief chapter only is devoted to the question, although the author must be aware that extensive investigations and wind tunnel tests have been made recently upon air friction on surfaces.

The student desiring a text-book of elementary fundamental principles will be wise to lay out his money elsewhere; the practical engineer seeking a book to assist him to improve his knowledge of the plant under his charge will find the work somewhat academic and will miss detailed and illustrated descriptions of plant and appliances. However, the scientific investigator and designer desiring a useful work of reference will welcome, under one cover, the innumerable formulæ and the mine of information in tabloid form, which are the characteristic features of the book.

Electricity for Everybody—Handbook for 1931. By R. BORLASE MATTHEWS. Pp. lxxxvii+469; illustrated. London: Electrical Press, Ltd. Price 5s. net.

The first edition of this compact and unique compendium appeared in 1908 to supply the need for authoritative information concerning the uses of electricity. The fourth edition newly issued has been completely rewritten in accordance with a novel plan of sectionalisation and it is now designed for annual re-issue.

The book contains a diary and calendar to March of next year and also a gazeteer of suppliers and a directory of contractors. For the latter items the author cannot be held directly responsible, but in future editions the lists require careful revision for there are omissions, names are included of firms who are not contractors, and many others are not marked in accordance with the index symbols.

The diary has double money columns and each day is numbered. The author suggests that these days of the year numbers may be used as a private code on documents. Each weekly page ends on Sunday when one may fill in the meter readings in the space provided—and presumably note with satisfaction the upward tendency.

The pages are thoughtfully adapted for tearing out, lines being printed for this purpose, and alternative punch indicating circles are given, all in accordance with the "DE-DA" system patented by the author. There is much other evidence of originality throughout the work which cannot be enumerated in the review space available. Over 150 line drawings are included; many are of familiar objects presented in a striking way—not always strictly in scale.

This handy volume devotes a division to general principles of electricity; the other main divisions are electricity in the home, in business, in public buildings, in factories, and in farms and gardens. Each division is sectionalised on a uniform plan which facilitates ready reference. Special prominence is given in each department as to "what a unit will do."

At the end of every section is a list of applicable apparatus and it is suggested that the reader should tick off the appliances which he has in use and not be content until his premises are completely electrified.

Der Elektrische Unfall—Skizziert für Ingenieur und Arzt. By DR. STEPHAN JELLINEK. Pp. 168; figs. 50. Leipzig and Vienna: Franz Deuticke. Price, 8 Rm. (8s.).

This is a work, printed in German, dealing with the subject of electrical accidents, and the fact that a third enlarged edition has been found necessary is evidence that it contains a good deal of valuable information. The author, Dr. Stephan Jellinek, professor of electro-pathology at the University of Vienna, has written the book with the object of providing engineers and medical men with some knowledge as to the best methods to be adopted in the various categories of accidents in connection with electrical installations that may for one reason or another occur.

The book is divided into ten chapters, one being devoted to a consideration of accidents in connection with telephones, Röntgen-ray apparatus, wireless sets, fires and explosions caused by electricity, &c., and another to the treatment of persons who have been injured by coming into contact with electrical apparatus and conductors. Not the least valuable part of the work is the illustrations reproduced from sketches and photographs showing not only many causes of electrical accidents but also the effects of such accidents and the treatment to which the affected persons should be subjected. The work is one that may be commended to electrical engineers generally, since, carefully studied, it should bring about a reduction in accidents and go towards the saving of life when they do occur.

We understand that a French edition of the book is to be issued, while doubtless if there were a sufficient demand the publishers, who hold the copyright of Dr. Jellinek's work in all countries, would be prepared to issue an edition in English.

Italian Electrotechnical Congress

The 36th annual congress of the Associazione Elettrotechnica Italiana, which is to be held in Perugia in September next, is to be mainly devoted to papers on electric power transforming sub-stations. Already over thirty contributions on the subject have been promised.

Parliamentary Notes

[By our Special Parliamentary Reporter]

Main-line Railway Electrification

On May 13th SIR N. GRATTAN-DOYLE asked the Minister of Transport whether he could make any statement as to the Government's policy with regard to the recommendations of the Committee on main-line railway electrification.

MR. MORRISON said he had asked the principal railway companies to consider the report and to furnish him with their observations upon it as soon as they could.

Replying to another question on the subject on Tuesday last, the Prime Minister said that the technical and economic problems raised by the Weir Committee's report required the railway companies' consideration in the first place. Meanwhile it would be premature for the Government to attempt to define its policy in the matter.

Foreign Plant in Railway Schemes

On May 13th SIR N. GRATTAN-DOYLE asked the Minister of Transport whether he had any information as to the extent to which foreign plant and materials had been used in recent schemes of railway electrification; and whether it was a condition of the grant of State assistance to any scheme that all the plant and material used must be British.

MR. MORRISON said that the conditions of grant under Part I of the Development (Loan Guarantees and Grants) Act, 1929, required that: "All plant, machinery, and materials required to be purchased by the company in connection with the assisted works (including any replacement of stores drawn from stock) are to be purchased in the United Kingdom at prices which are fair and reasonable, having regard to all the circumstances; and all materials required so far as practicable to be of United Kingdom origin, and all manufactured articles to be wholly manufactured in the United Kingdom, subject to such exceptions as the Committee may approve beforehand as necessary or desirable in any particular case, having regard to all the circumstances, including the comparative prices of British and foreign articles. The company shall insert a like condition in respect of all contracts placed by them in connection with the works and shall take all reasonable steps to secure its observance."

One railway company, which had received a grant for an electrification scheme, reported that certain expenditure, representing less than one-tenth of one per cent. of the whole cost, would necessarily be incurred outside the United Kingdom and was notified that that expenditure would not rank for grant. He had no official information as to the details of expenditure on railway electrification schemes which had not received State assistance.

Electricity in Southern England

On May 13th CAPTAIN MACDONALD asked what was the present position with regard to electrification schemes in the South of England; how soon such schemes would be completed; and how the final cost would compare with the estimated cost.

MR. MORRISON said he was informed by the Central Electricity Board that the schemes under the Electricity (Supply) Act, 1926, for the South of England were progressing satisfactorily, but that it was too early to state definitely when the schemes would be completed, and how the final cost would compare with the estimates.

Electricity Supply in York Rural Area

On May 13th MR. TURTON asked the Minister of Transport whether he was aware that, although the York Corporation was given powers, under the York Electricity (Extension, &c.,) Special Order, 1929, to extend its area so as to include the parishes or townships of Welburn, Sheriff Hutton, Farlington, Stittenham, Bulmer, Whitwell, Terrington, Foston, Ganthorpe, Huttons Ambo, and Barton-le-Willows, it had taken no steps to supply this part of its area with electricity, notwithstanding the demands of the inhabitants; whether he would urge the York Corporation to submit a scheme for this part of its area; and whether he would assist the undertakers in such a scheme by contributing a grant towards the cost in order to provide work for the unemployed in that district.

MR. MORRISON said he was informed that the Electricity Commissioners some time ago discussed with the York Corporation a scheme for the supply of electricity in the rural area for which the Corporation obtained powers under the Special Order of 1929, and that the Corporation, with assistance from the Unemployment Grants Committee, was carrying out works in the greater part of the area. The Corporation was not at present satisfied that, even with such assistance, the supply to the villages referred to would be self-supporting. It was, however, carrying out a further canvass.

Slackening in Telephone Business

On May 11th MR. O. LEWIS asked the Postmaster-General if he could state why the increase in the number of telephone subscribers for the year 1930-31 was less than that for any of the preceding six years.

MR. ATTLEE said that the falling-off in the net telephone growth in 1930-31 was due to the prevailing economic depression. The falling-off in 1930 in Germany and the United States of America was very much greater, being about 75 per cent. and 85 per cent., respectively, as against 15 per cent. in this country.

Telephone Development

On May 15th, MR. VIANT, Assistant Postmaster-General, moved the second reading of the Post Office and Telegraph (Money) Bill. He explained that of the £32,000,000 authorised to be issued out of the Consolidated Fund for developing the postal, telegraphic and telephonic system, all except £2,800,000 was for the telephone service. They had about £2,000,000 in hand, so that there would be a total of £31,200,000 for this purpose. They were basing their estimates on what had taken place during the last three years, when, in spite of trade depression, they had connected 110,000 new subscribers each year. He held that the Department had done exceedingly well, more especially when they bore in mind the fact that there had been a slackening of progress in America and Germany. These were the only two countries which had more telephones than Great Britain. But until the Department could get the general public to understand that a telephone should be accepted as a mechanic accepted a tool which would enable him to accomplish a certain type of work, they would not have removed one of the chief obstacles in connection with telephone development. In view of the criticisms that had been levelled at the Department he would give some figures showing the advance made during the last five years. In March, 1919, the number of stations was 830,000, and the increase in the twelve post-war years had been 1,150,000, or nearly 140 per cent. The number now closely approximated the 2,000,000 mark, and the second million stations had been added to the system in rather less than nine years. There were now 35,000 public call offices, and 10,000 of these were in kiosks in public thoroughfares, and were therefore available at all hours of the day and night. The growth of the call offices since 1925 had been 85 per cent.

Rural call offices now numbered about 14,000, the increase in the last six years being 135 per cent. The number of private house telephones had increased by over 100 per cent. in the last six years. The present number of 536,000 should be compared with 158,000 in July, 1922. They had established a considerable number of rural exchanges; no fewer than 1,000 of these had been provided in the last six years, representing a growth of over 40 per cent. In the last three years most of the rural exchanges had been of the automatic type, and provided a continuous service. On March 31st last there were 360 exchanges of that type. In rural areas they were doing far better than Sweden, which was so often held up as an example. The number of exchanges in London was now 150, compared with 137 at the end of 1929, and 32 of those were automatic. The total number of telephone subscribers in the London area in 1930 was 703,500, an increase of 41,523, or 6.3 per cent.

The Department had been criticised for its high costs, but those who criticised failed to appreciate the difference in our system compared with those of other countries which were used as an illustration.

In America buildings were designed so that the telephones could be installed and the wires concealed during the erection of the building, but in London the telephones were put in after the building had been completed, which all added to the expense. Sweden had a great advantage in having timber for its poles on the spot, and it was the exception to have wires underground. To restore roads in London after putting wires underground cost six times more than in Sweden. All those facts added to the initial cost. With new methods, the Post Office was now more ready than hitherto to comply with orders.

After a good deal of criticism, to which Mr. Attlee, the Postmaster-General, replied that his Department was going to try an "up-to-date selling campaign," the Bill was read a second time.

The London Transport Bill

The Joint Committee of both Houses resumed consideration of the London Passenger Transport Bill last week. It was announced that the Minister of Transport had reached an agreement with the four main-line railway companies and they had withdrawn their opposition. The settlement provided for the pooling of passenger receipts in the London area with those of the undertakings controlled by the proposed Transport Board. Mr. Wilfrid Greene, K.C., for the promoters, stated that the agreement would remove the unregulated and uneconomic competition which the railways feared, and, moreover, would assist electrification. With regard to the method of compensating the local authorities for the handing-over of their tramway undertakings, Mr. Greene said that the conclusion had been reached that the only fair way of dealing with them was to repay their outstanding obligations. Of the 14 undertakings concerned, nine had consistently shown a loss in recent years; only Ilford Corporation had consistently made a profit. In this matter both profits and losses had to be disregarded. It was proposed that cash should be paid to the Metropolitan Railway in respect of certain shares, but that was against the principle of the Bill and was different from the scheme which was to be applied to the "Underground" companies.

SIR HENRY MAYBURY, giving evidence for the Bill, said that the means proposed were in accordance with the views of the London Traffic Advisory Committee, of which he was chairman. It was essential that the transport business should be a monopoly if unification and improvement were to be effected. Sir Henry was subjected to considerable cross-examination by opponents' counsel.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

A Pioneer in Wireless

In a recent leading article in *The Times* under the above heading the writer winds up by saying, "There can be no doubt . . . . that Hughes was some seven years ahead of Hertz in knowing the existence of such waves, and was thus one of the earliest pioneers in wireless communication." Now, without saying bluntly that this statement is incorrect, I would take strong exception to the arguments which the writer uses to prove his contention. He says that Hughes "walked along the street armed with a telephone *and one of his microphone contacts*, and was able to detect sounds in the telephone up to a distance of 500 yards." If this statement were correct, it would, of course, go very far to prove the contention, but, as an actual witness of Hughes' experiments (I was sent by Sir, then Mr., W. H. Preece, engineer-in-chief to the Post Office to see them) I must state that the assertion that *a microphonic contact was connected to the telephone* is quite wrong; the telephone (an ordinary old-fashioned receiver) had nothing whatever connected to it, and it was this fact that made Sir George Stokes, Prof. Huxley, Mr. Spottiswoode, and myself believe that the results obtained were due to electro-magnetic induction and nothing else. Further, the writer of the article says that "the short glass tube filled with metallic filings was an obvious projenitor of the Branley coherer"; here again the writer is utterly wrong; the "glass tube filled with metallic filings" of Hughes was in no respect akin to the Branly coherer, except as regards its construction; the Hughes tube was used only as a "transmitter," the Branly tube only as a "receiver." Had the Hughes tube been used as a "receiver" and had a microphonic contact been connected to the receiver in the experiments referred to, the case for Hughes as a pioneer of wireless would have been proved, I think, beyond doubt; but, as neither of the statements are correct, the matter remains somewhat doubtful. I must, however, state that the following fact is a very significant one. On my saying to Prof. Hughes that the results obtained were due to induction, he took me up sharply and said, "No, the results are due to *con*duction." I suggested enclosing the transmitting apparatus in a glass case, so as to prevent *con*duction from taking place. He then said, "This would make no difference; *con*duction would take place through the glass." I cannot now call to mind what was the arrangement of the whole transmitting apparatus. I can only remember for certain that there was a light make and break worked by clockwork, but the fact with regard to the absence of any microphonic contact connected to the receiver I am sure of, and needless to say this is an all important point.

H. R. KEMPE.

Bletchworth, Surrey, *May 19th*, 1931.

"Use Bakelite"

The recent correspondence on the subject of using "Bakelite" brought forth (in your issue of May 15th) a letter from Mr. G. W. Cooper, in which he states that he would value an opinion on the suitability, or otherwise, of "Bakelite" as a medium for commutator construction. As one who has devoted fifteen years exclusively to commutator construction, my views may be of interest. During the course of my work it has been necessary to manufacture replacement commutators for all makes of motors, and it has been brought clearly to my notice that the "moulded" commutator is much more frequently in trouble than its fellow of the metal and mica construction. Examination of some hundreds of failures of "moulded" commutators has led me to the conclusion that moulded synthetic resin with asbestos or any other "filler" is definitely unsuitable for commutator construction, except possibly for very small commutators under one inch in diameter. The defects of this form of commutator construction may be summed up as follows:—

(1) Lack of heat conductivity in the moulded material causes the segments to run hotter than the metal-mica type.

(2) Continued local heating and cooling loosens the segments in some cases.

(3) In other cases the commutator first becomes out of round or develops high segments; this causes local sparking which adds to the heat and in severe cases causes the moulded material to crack, with consequent complete failure of the commutator.

(4) The moulded material easily carbonises and is quite useless after the passage of a small arc across its surface; the carbonised area rapidly spreads, and I have seen moulded commutators which have "gone to earth" through the local carbonisation of nearly half an inch of moulded material.

(5) Overheating of the commutator during soldering of the armature conductors can seriously damage the moulded material.

(6) The mechanical properties of the moulded substance are unsuitable for the construction of high-speed commutators, the factor of safety against bursting being small and of an uncertain figure; this can be improved by the moulding in of steel re-inforcing rings, but this practice greatly increases the risk of electrical breakdown, and adds to the cost of production, so that no advantage is shown over the metal-mica type.

In nearly all the cases of failure investigated it was observed that the commutator segments were very little worn, indicating that these troubles have occurred comparatively early in the life of the commutator. In general, my view is that the only reason for the use of moulded synthetic resin for building and insulating commutators is that it is an easy way of making them. A capable and experienced commutator maker can always produce a sound commutator using the metal and mica construction; it can be adapted to any size, and is actually cheaper than the moulded construction for small quantities, while for quite large quantities the comparative costs, when made under similar productive conditions, are only slightly in favour of the moulded type. The difference in reliability of the two products would outweigh even a considerable price difference with any one who was really acquainted with the troubles of "cheap" commutators.

London, S.W.19, *May 18th*, 1931. A. O. HINCHLIFF.

Your correspondent Mr. G. W. Cooper asks for opinions as to the suitability of "Bakelite" and similar materials for the construction of small commutators. For the past ten years or so I have been experimenting with various types of moulded commutators, and up to the present I have been unable to find a material which will stand up to service without breaking down, in precisely the manner described by your correspondent, due to the formation of a conducting track on the face of the moulding—a fault generally known as "tracking." The cause of this phenomena appears to be somewhat obscure, but it is probable that a minute initial conducting path is formed, either of carbon dust or soldering flux. Once the "track" is established its conductivity rapidly increases. Some makes of materials are better than others in this respect, the best in my experience being some of Continental manufacture, but even these commutators are by no means reliable.

Manufacturers of the moulding material state that they can supply "*anti*-tracking Bakelite," but *non*-tracking material cannot be produced so long as carbolic acid enters into the manufacturing process. "Bakelite" brush tubes are also a source of trouble due to tracking. The writer uses a British anti-tracking material for these, which is very successful. It is, however, inferior in finish to standard "Bakelite," and for this reason ebonite tubes may be preferable.

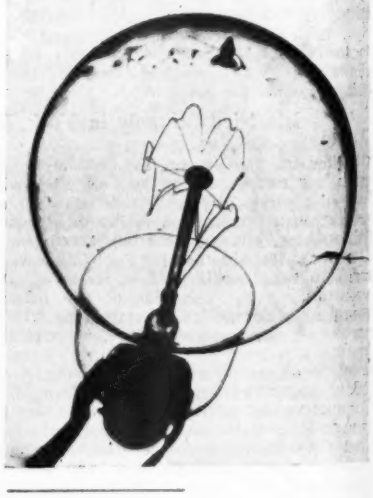
Throughout this letter I have used the term "Bakelite" to cover all classes of moulded material.

Swindon, *May 19th*, 1931. S. J. PHILPOTT.

An Insect in a Lamp

I enclose a photograph of a 100-watt gas-filled lamp which has been found to have an insect inside the bulb. This seems to be somewhat of a novelty and it would be interesting to know how and when the insect got inside, and also whether it was alive when it did so.

JAMES F. DRIVER.
Loughborough,
May 12th, 1931.



Fatality

An inquest was held at West Hartlepool last week on David John, of South Shields, an engineer on the *City of Canberra*, who was killed in the engine room of the vessel while it was in dry dock at Messrs. Gray & Co.'s yard at Graythorpe, Hartlepool. Evidence showed that John had been told to tilt a lamp so as to give a better light on some work which the chief engineer was inspecting. After tilting the lamp he cried out, and the lamp was torn from his grasp by the second engineer. The electrician employed by Messrs. Gray who fixed the lamp said that in his opinion some of the wire connections must have been bared in moving the lamp. The voltage was about 250. A verdict of "accidental death from shock caused by defective wires or fittings" was returned.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1929

23,277. "Ships' and other similar telegraphic apparatus." Chadburn's (Ship) Telegraph Co., Ltd., and A. C. Bamford. April 29th, 1930. (347,294.)

31,561. "Heating metallic and other electrically-conducting bodies." S. E. Kusnetzov. October 17th, 1929. (347,163.)

33,017. "Thermionic valve circuits." P. H. Greeley. October 30th, 1929. (347,296.)

34,575. "Circuit arrangements for maintaining constant voltage." L. Koros. November 12th, 1928. (347,094.)

1930

1,188. "Methods of controlling vapour electric devices." British Thomson-Houston Co., Ltd. January 12th, 1929. (347,127.)

1,400. "Ships' and other similar telegraphic apparatus." Chadburn's (Ship) Telegraph Co., Ltd., and A. C. Bamford. January 15th, 1930. (347,177.)

1,568. "Electrodes for resistance welding and method of making same." Fansteel Products Co., Inc. January 17th, 1929. (347,207.)

1,671. "Thermomagnetic therapeutic appliances." W. E. Holder. January 17th, 1930. (347,128.)

1,777. "Wireless receiving apparatus." Paragon Rubber Manufacturing Co., Ltd., and G. W. Croot. January 17th, 1930. (347,180.)

1,917. "Electric switches, more particularly switches for high-potential conductors." W. W. Triggs (Ohio Brass Co.). January 20th, 1930. (347,209.)

1,925. "Generation of alternating electric currents for use in induction furnaces and for other purposes. N. R. Davis, C. R. Burch, and Associated Electrical Industries, Ltd. January 20th, 1930. (347,248.)

1,929. "Vacuum electric tube devices or valves." N. R. Davis, C. R. Burch, and Associated Electrical Industries, Ltd. January 20th, 1930. (347,210.)

1,982. "Terminals or couplings for electric cables." General Electric Co., Ltd., and W. Wilson. January 20th, 1930. (347,213.)

1,993. "Electric switches." F. A. Smith. January 20th, 1930. (347,214.)

2,012. "Selective receiving systems for operating clocks or other mechanisms. C. Lipmann, A. Strahm, and A. Quinche. January 26th, 1929. (Patent of addition not granted.) (347,112.)

2,016. "Electric recorders." Marconi's Wireless Telegraph Co., Ltd. January 19th, 1929. (347,250.)

2,036. "Telegraphic signal regenerator." Creed & Co., Ltd., and R. D. Salmon. January 21st, 1930. (347,116.)

2,155. "Television and like apparatus." J. L. Baird, and Television, Ltd. (in liquidation). January 21st, 1930. (Cognate applications 5,129/30 and 17,253/30.) (347,254.)

2,289. "Automatic regulation of the voltage of variable-speed dynamos." J. Stone & Co., Ltd., and A. L. Ash. January 22nd, 1930. (347,190.)

2,393. "Sound-recording apparatus and arrangements for use therewith." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. January 23rd, 1930.) (Cognate application 31,044/30.) (347,260.)

2,394. "Sound-recording systems." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. January 23rd, 1930. (Cognate application 28,912/30.) (347,261.)

2,396. "Apparatus for reproducing sound." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. January 23rd, 1930. (347,262.)

2,524. "Telegraph transmission systems." Standard Telephones & Cables, Ltd., and A. T. Starr. January 24th, 1930. (347,265.)

2,533. "Combined sound and motion picture films." Electrical Research Products, Inc. January 25th, 1929. (347,226.)

2,586. "Electrically-operated extensible chairs." O. H. Pieper, and A. F. Pieper. September 16th, 1929. (347,229.)

2,676. "Thermionic valve frequency multipliers." Marconi's Wireless Telegraph Co., Ltd., C. G. Kemp, and L. G. Kemp. January 25th, 1930. (347,272.)

2,686. "Dynamo-electric machines." Electric Machinery Manufacturing Co. January 25th, 1929. (347,277.)

2,718. "Electric signalling systems employing alternating currents." Siemens Bros. & Co., Ltd., and A. T. C. Moore. January 27th, 1930. (347,280.)

2,745. "Train-lighting electric generators. W. A. Pitt. January 27th, 1930. (347,281.)

2,825. "Thermionic valve systems." Gramophone Co., Ltd., and H. C. Atkins. January 27th, 1930. (347,291.)

3,182. "Combined electric cut-outs and voltage or current regulators." J. Lucas, Ltd., and C. E. Robinson. January 30th, 1930. (347,299.)

3,222. "Regenerative systems of control for electrically propelled vehicles." British Thomson-Houston Co., Ltd., and H. C. Hastings. January 30th, 1930. (347,301.)

3,224. "Sound-reproducing apparatus." G. F. Rayner. January 30th, 1930. (347,302.)

3,414. "Cathodes of vacuum electric tube devices." E. Y. Robinson, and Associated Electrical Industries, Ltd. January 31st, 1930. (347,311.)

3,621. "Scanning devices for use for example, in television." Gramophone Co., Ltd., and R. B. Morgan. February 3rd, 1930. (347,321.)

3,650. "Lighting appliances." Holophane, Ltd. (W. A. Dorey). February 3rd, 1930. (347,322.)

3,842. "Electric cookers." Chesterton, Jones & Co., Ltd., and F. F. D. Davidson. February 5th, 1930. (347,331.)

4,181. "Electric switching apparatus." R. C. Graseby. February 7th, 1930. (347,338.)

4,205. "Measuring apparatus for electric high-potential circuits." British Thomson-Houston Co., Ltd., and C. G. Mayo. February 7th, 1930. (347,339.)

4,769. "Signalling device for controlling street traffic." W. Huizinga. February 12th, 1930. (Convention date not granted.) (347,352.)

4,788. "Electric testing apparatus." Allgemeine Elektricitäts-Ges. February 12th, 1929. (347,353.)

5,386. "Constant-current electric generators." G. Austin, J. C. MacFarlane, and W. A. MacFarlane. February 18th, 1930. (347,359.)

5,448. "Hygrometric apparatus employing an electric circuit." Siemens & Halske Akt.-Ges. February 20th, 1929. (347,361.)

6,714. "Rheostatic braking of electrically-propelled vehicles." C. Johnson, and Associated Electrical Industries, Ltd. February 28th, 1930. (347,381.)

6,796. "Electric plug-and-socket connections." J. B. Tucker. March 1st, 1930. (347,384.)

6,991. "Heating of fluids of all kinds by means of electrically-heated resistances." L. G. Leffer, and P. Van Bergen. March 3rd, 1930. (347,386.)

7,931. "Electrical condensers." F. J. H. Charman. March 11th, 1930. (347,402.)

8,415. "Electrical terminal boxes." Siemens-Schuckertwerke Akt.-Ges. March 20th, 1929. (347,410.)

8,867. "Current transformers." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. March 20th, 1929. (347,414.)

9,336. "Electrical treatment of soil for agricultural and horticultural purposes." J. Zacher. March 24th, 1930. (347,418.)

10,022. "Radio-frequency distributing systems for use in connection with broadcast and like receivers." Marconi's Wireless Telegraph Co., Ltd. March 29th, 1929. (347,431.)

10,063. "Illuminated advertisement signs." M. R. H. Sadler. March 29th, 1930. (347,434.)

10,087. "Television systems." Marconi's Wireless Telegraph Co., Ltd. April 1st, 1929. (347,435.)

10,144. "Electrical switches, relays, and the like to give repeated operations." General Electric Co., Ltd., and J. J. V. Connaughton. March 31st, 1930. (347,438.)

10,162. "Sparking plugs." C. Welch, and J. Thompson. March 31st, 1930. (347,439.)

11,825. "Electrical signalling systems." Siemens & Halske Akt.-Ges, April 13th, 1929. (347,468.)

12,069. "Converting apparatus." British Thomson-Houston Co., Ltd. April 18th, 1929. (347,474.)

15,106. "Cathodes of electron discharge tubes or thermionic valves." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 9th, 1929. (347,500.)

15,137. "Precipitation electrode for electrical gas purification." Siemens-Schuckertwerke Akt.-Ges. May 18th, 1929. (347,501.)

15,310. "Antenna arrangement for short and ultra-short waves." C. Lorenz Akt.-Ges. October 30th, 1929. (347,503.)

15,353. "Whaling lines with electric leads." A. Saebjornsen, and K. J. Saebjornsen. May 19th, 1930. (347,504.)

15,739. "Electric circuit make-and-break devices or flashers." General Kontrolar Co., Inc. May 31st, 1929. (347,507.)

15,874. "Control means associated with the automatic synchronising of dynamo-electric machines." G. Maher. May 23rd, 1929. (347,509.)

16,526. "Couplings for electric conductors." British Dardelet Threadlock (D.D.G.) Corp., Ltd. June 1st, 1929. (347,513.)

16,653. "Double-tariff and like apparatus for electric supply systems." Siemens-Schuckertwerke Akt.-Ges. May 30th, 1929. (347,516.)

17,969. "Means for starting up the electric motors of spinning machines." Siemens-Schuckertwerke Akt.-Ges. June 12th, 1929. (Addition to 299,886.) (347,524.)

17,979. "Aerial systems." Telefunken Ges. für Drahtlose Telegraphie. June 11th, 1929. (347,525.)

18,035. "Inductance coils for wireless signalling apparatus." General Electric Co., Ltd., and N. J. McAinsh. June 12th, 1930. (347,526.)

18,261. "Housings or cases and covers for electric switches." R. Bosch Akt.-Ges. June 17th, 1929. (347,529.)

19,451. "Mechanical high-tension rectifiers." Metallges Akt.-Ges. August 31st, 1929. (347,535.)

19,869. "Regulating means for electric transformers." International General Electric Co., Inc. June 29th, 1929. (347,538.)

20,435. "Photo-electric cells." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 24th, 1929. (347,544.)

20,668. "Electric cable connectors for sparking plugs or the like." Fabrica Italiana Magneti Marelli. July 9th, 1929. (347,546.)

21,276. "Ignition switches for internal-combustion engines." British Thomson-Houston Co., Ltd., L. Griffiths, and C. J. Morton. July 14th, 1930. (347,549.)

24,114. "Rotors for asynchronous alternating-current motors." Dual Motors, Ltd. October 5th, 1929. (347,558.)

24,664. "Luminous electric discharge tubes." General Electric Co., Ltd. October 19th, 1929. (Addition to 316,611.) (347,559.)

1931

1,817. "Lighting appliances." Holophane, Ltd. (W. A. Dorey). February 3rd, 1930. (Divided application on 347,322.) (347,571.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 13th, 1931:—

Kobradio (lettering and design). No. 519,302. Class 8. Radio receiving sets, radio receiving sets in combination with gramophones, and component parts of such goods.—Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

Eldoradio. No. 521,925. All goods in Class 8.—W. Semper, trading as the Eldoradio Manufacturing Co., 93, Vancouver Road, Edgware, Middlesex.

Philite. No. 521,216. Class 50. Condensation products of phenol and formaldehyde sold in the form of solid masses for use in moulding articles.—Naamlooze Vennootschap Philips Gloeilampenfabrieken, Eindhoven, Holland. (British representatives: Dicker, Pollak & Mercer, 20-23, Holborn, E.C.1.).

Nestorite. No. 522,056. Class 50. Synthetic resin moulding powders for electrical insulation purposes.—James Ferguson and Sons, Ltd., Prince's Road, Merton Abbey, S.W.19.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—Houses (72), Hollins estate; H. Sanderson, borough engineer, Town Hall.

Alfreton.—Houses (64), Council estate (19,772); G. H. Brentnall.

Armadale.—Cinema (1,150 seats); T. Roberts & Son, architects, Bathgate.

Barrow-in-Furness.—Girls' secondary school (£31,639); Rainey Bros., Ltd., builders.

Beaconsfield (BUCKS.).—Houses (40) for the U.D.C.; A. W. Taylor, builder, Chalfont St. Peter.

Bilston.—Two schools for the E.C.; director of education. Houses (344) for the U.D.C.; surveyor.

Blackpool.—Tramway station at Bispham (£2,600); borough engineer. School, Bispham, for the borough E.C.; director of education.

Bolton.—Church, Smethhurst Lane; Wm. Gornal & Sons, Ltd., builders, Ellesmere Street.

Boston (LINCS.).—Houses (38) for the R.D.C.; surveyor.

Bournemouth.—School clinic for the T.C.; F. P. Dolamore, borough engineer.

Bristol.—Elementary school, Southmead estate, for the E.C. Three temporary schools at housing estates; Stock & Collings.

Bury.—Flats (56), Ainsworth Road (£16,202), for the T.C.; J. Gott, builder, Pilsworth Road, Heywood.

Cargill (N.B.).—Sewage disposal works for Perth and Kinross C.C.; H. J. Bell, chartered surveyor, 18, Charlotte Street, Perth.

Carlisle.—Houses, Blackwell estate (£28,844), and Newtown estate (£7,728); J. Laing & Son, Ltd. Conversion of Dovendon Hall into institution for defectives (£25,000); Armstrong, contractors, Cockermouth. Stores, London Road; Benwell & Slack, architects.

Cheam (SURREY).—Church (£20,000) for the Presbyterian Trustees; secretary.

Cheshire.—Modern school, Frodsham (£15,500), for the county E.C.; F. A. Browne, county architect, Chester. Hostel, Crewe Training College (£17,450); Jonathan Partington, Ltd., builders, Middleton Junction.

Chesterfield.—Houses (48), Newbridge Lane; borough engineer. Radium room, Chesterfield Hospital, Holywell Street; governors. Reconstruction of four schools (£15,000) for the E.C.

Chipping Sodbury.—Houses (68) for the R.D.C.; W. H. Williams and H. S. Hale, architects.

Coatbridge.—Extension of secondary school and reconstruction of primary school; executive officer to the Education Authority.

Cornwall.—Secondary school, St. Austell (£18,200), for the county E.C.; education architect, Truro.

Coventry.—Houses (470) for the T.C.; A. F. Underhill, housing director.

Dartford.—Extension of mills for the London Paper Mills Co., Ltd.

Deal.—Houses (46) for the T.C.; T. C. Golder, borough surveyor.

Dukinfield (CHESHIRE).—Houses (92) for the T.C.; borough surveyor.

Durham.—Public baths and wash houses for the T.C.; J. W. Green, city engineer.

Edinburgh.—Conversion of building into hospital for Corporation (£21,000); city architect.

Evesham (WORCESTERSHIRE).—Extensions to infirmary (£17,250); county architect.

Farsley (NR. LEEDS).—Houses (44), at Stoney Royd estate, for the U.D.C.; E. Bray, architect, 113, Town Street, Stanningley.

Gateshead.—Houses (152) for the T.C.; W. E. Hall & Son, contractors, Low Fell.

Glasgow.—Reconstruction of the Florida Cinema, Kings Park; J. Gibson & Co., Ltd., builders, Langside Road. Omnibus garage (£60,000), Anniesland; city engineer. Offices, St. Vincent Street, for J. & P. Coats, 50, Rothwell Street; Shaw & Campbell, Ltd., builders, 136, Paton Street.

Grimsby.—Hospital extensions (£50,000); H. Ashton, builder, Barton-on-Humber. Reconstruction of fish market for the London & North Eastern Railway Co.; A. Jackaman & Son, Ltd., builders, Slough.

Harrogate.—Branch stores, Otley Road, for Harrogate and District Co-operative Society, Ltd.; architect's dept., Co-operative Wholesale Society, Ltd., 1, Balloon Street, Manchester.

Hastings.—Houses (108), Hollington estate (£41,625); J. Bodle, Ltd.

Headington.—Houses (26) for the R.D.C.; W. A. Daft, architect, 9, New Road, Oxford.

Hebburn (CO. DURHAM).—School (800 places) for the U.D.C.; Mr. Paterson, surveyor.

Herefordshire.—Senior school, Leominster, for the county E.C.; director of education, Hereford.

Hertfordshire.—School, Rickmansworth, and alterations to central schools, St. Albans, for the county E.C.

Hexham.—Houses (100) for the R.D.C.

Ince (LANCS.).—Houses (216) for the U.D.C.; surveyor.

Ipswich.—Rebuilding of premises, Tavern Street; Sadler and Sons, builders, 81, Richmond Road.

Lancashire.—Gymnasium, Farnworth Grammar School (£4,000), for the county E.C.

Liverpool.—Billiard hall and shops, Hope Street; W. Tomkinson & Sons, builders, Great Newton Street.

London.—Dormitory block, Freemen's Schools (£10,000), City of London School Committee. (ABBEY WOOD).—Houses (30), Bostall estate, and assembly hall, Federation Road; Royal Arsenal Co-op. Society, Ltd. Postal sorting office, Conference Road; H.M. Office of Works. (BLACKHEATH).—Houses (86), Kidbroke Park estate; Coleridge, Jennings & Soimenow. (BROCKLEY).—Houses (30), Amyruth Road; J. W. Heath and Sons. (CAMBERWELL).—Development of Grove Park estate; W. J. Brise. Extensions to Municipal Offices, Peckham Road; borough engineer. (CHARLTON).—Factory extension, Anchor Lane; United Bottle Manufacturers (Charlton), Ltd. (ELTHAM).—Houses (24), Southwood Road; W. J. Brise. Cinema, Shepherds Farm estate, Well Hall, for Messrs. Laing. Shops and flats, High Street; Foster & Foster. (FINSBURY).—Extensions to Cordwainers College, Albion Place; governors. (HACKNEY).—Trade school for girls, Cassland Road (£31,650); L.C.C., architect. (ISLINGTON).—Enlargement of Poole's Park School; L.C.C., architect. (LEWISHAM).—Factory, Meadowcourt Road; H. R. Adams. (PADDINGTON).—Extensions to general offices, &c., Paddington Station; Halliday & Greenwood, Ltd. (PLUMSTEAD).—Factory extension, 54, King's Highway; Mackintosh Bros., Ltd. (POPLAR).—Tenements, West Ferry Road (£122,000); L.C.C. architect. (PUTNEY).—Blocks of flats and houses, North House estate; Crickmay & Sons. (SOUTHWARK).—Housing scheme, Orphans' Home, Austral Street; borough engineer. Extensions to premises in Stamford Street; Westminster Bank, Ltd. (STREATHAM).—Shops and flats, Streatham Hill and Telford Avenue; F. J. Harrington. (WOOLWICH).—Housing scheme (275 acres), near Eltham Road; borough engineer.

Macclesfield.—Central school for the borough E.C.; director of education.

Manchester.—Alterations to premises, Chapel Street, for W. Hind, Ltd.; H. H. Brown, architect, 20, Brazenose Street. Bank for the District Bank, Ltd., Carmell Road; J. Sutcliffe & Sons, builders, Alexandria Road, St. Annes-on-Sea. Showrooms and offices, Market Street, High Street, and Bridgwater Street, for Marks & Spencer, Ltd.; Bovis (1928), Ltd., builders, 43, Upper Berkeley Street, London, W.1. Eight shops on the Victoria Avenue East estate, Blackley, for the C.C.; H. Price, architect, Town Hall, Manchester. Old Moat Municipal Senior School; director of education, Education Offices, Deansgate.

Marlborough.—Grammar school extensions (£5,355); P. King, builder, Pewsey.

Monmouthshire.—Secondary school, Bassaleg, for the county E.C.

Newport. (I. O. W.).—Houses Barton Road and School Lane; borough engineer.

Newport (MON.).—Additions to Municipal Offices, Corn Street, and enlargement of Alexandra Girls School; borough architect.

North Walsham.—Cinema (650 seats), New Road; T. Gill and Son, contractors, Norwich.

Oxford.—Houses (33), Banbury Road; A. J. Colbourne. Houses (30), Cold Arbour estate; city surveyor.

Portsmouth.—Alterations, Princes' Cinema, Lake Road; Mr. Wakeley, architect. Alterations, Rialto Cinema, Arundel Street; Rialto Co. First section (500 patients), Portsdown Hill Mental Colony; L. G. Stokes, architect. Elementary school, Northern Parade (£75,459); F. Bevis, Ltd.

Preston.—Houses (56), Basil Street, for the T.C.; borough engineer. Houses (342), P. A. Baines & Son, builders.

St. Albans.—Mental colony, Cell Barnes, Hill End, for Hertfordshire C.C. (£188,000); H. M. Nowell, Ltd., contractors, Stockton-on-Tees.

Salisbury.—Hall, headquarters, offices, &c., for the Constitutional Association; F. L. Cracknell, secretary, 60, Catherine Street.

Somerset.—Secondary school (750 places), Weston-super-Mare, for the county E.C.; A. J. Toomer, county architect, Park Street, Taunton.

South Shields.—Houses (44), Ridgway estate (£13,882); J. Clark & Son, New Seaham. Extensions to Harton Dye Works; T. A. Page & Son, architects, 67, King Street. Extensions to Harton Institution; borough engineer. School centre, Dean Road; H. Hill, architect. Alterations, Westoe Hotel, Horsley Hill Road; T. A. Page & Son, architects.

Starcross (DEVONSHIRE).—Extensions to mental institution (£118,127); Exeter, Dorset and Somerset Councils.

Sunderland.—New block, central library; borough engineer. Extensions to laundry, High Field Poor Law Institution; W. and T. R. Milburn, 17, Fawcett Street. Conversion of Ashburne House into school of art; director of education.

Surrey.—School (1,100 places), Carshalton, for the county E.C.; W. W. Finny, secretary, Kingston-on-Thames.

Tadcaster.—Extensions, Garforth Infectious Diseases Hospital; H. W. Boardman, engineer to the R.D.C.

Truro.—Bank reconstruction; National Provincial Bank, Ltd.

Tynemouth.—Infectious diseases hospital for the T.C.; J. L. Beckett, surveyor.

Walsall.—Dental clinic, Field Street; Medical Officer of Health.

Warrington.—Houses (30), Kingsway; borough engineer. Alterations, Fennel Street, for Warrington Co-operative Society, Ltd.

Watford.—Houses (26) for the R.D.C.; surveyor.

West Dean (GLOS.).—Houses (300) for the R.D.C.; surveyor, Coleford.

West Riding.—Infants' school, Brampton Bierlow, for the C.C.; education officer, County Hall, Wakefield.

Wheathampstead.—Extension of C.E. school (160 places); Church managers.

Whitley Bay.—Rebuilding of Ship Hotel; R. Carse & Son, contractors, Amble and Morpeth.

Wimbledon.—Conversion of mansion into boarding school for the governors of King's College school; Hoad & Taylor, builders, Market Square, Horsham.

Wirksworth (DERBYSHIRE.)—Cottage hospital extensions; Chapman & Jenkinson, architects, 18, Norfolk Row, Sheffield.

Wortley (YORKS.).—Houses (152) for the R.D.C.; W. Marlow and Sons, Hillsborough, Sheffield (62); J. W. Bailey, Sheffield (42); and W. Memory, Swallownest (48), builders.